THE WEATHER AND CIRCULATION OF APRIL 1956 [1]

A Cold Month with a Retrograding, Blocking Surge

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1. INTRODUCTION

During April 1956 an intense blocking wave slowly retrograded across North America, and the United States experienced one of its most severe Aprils on record. Spring weather is frequently extreme and variable, but this month these characteristics were intensified by the strong blocking action. Cold waves, record late snow, duststorms, local floods, extended and alleviated droughts, damaging high winds, and tornadoes were reported by many stations throughout the country.

In this review, the monthly mean circulation and its evolution throughout the month is discussed with emphasis placed on the blocking. This is followed by a discussion of the monthly weather. First the monthly average is considered, and then it is separated into shorter periods to show the large variations which occurred during the month. Tables of unusual weather phenomena are shown to illustrate the great variability of this April's weather.

2. GENERAL CIRCULATION

THE MONTH AS A WHOLE

The basic monthly mean 700-mb. pattern (fig. 1) over North America consisted of a stronger than normal ridge in western Canada, a strong trough in central Canada extending south-southeastward through Maine into the western Atlantic, and a low-latitude trough over southern California. These features combined to give a weak confluence zone through the central United States and a strong, northwesterly flow from the Yukon into the southeastern United States. The 700-mb. monthly mean patterns for April and March 1956 [1] were rather similar in the Western Hemisphere, except that during April there was a strong ridge in the Greenland region. In fact, the largest positive height anomaly (+370 ft.) for April was observed near Greenland. This positive anomaly coupled with below normal heights in eastern United States was an indicator of the blocking that prevailed during the month. Similar blocking regimes were responsible for cold, stormy April weather in the United States during 1950 [2] and 1953 [3].

[1] See Charts I-XV following p. 178 for analyzed climatological data for the month.

The mean sea level chart (Chart XI) shows a significant belt of high pressure from the Arctic north of Alaska stretching southeastward to Florida. This delineates the path of several cold anticyclones which were steered by the upper-level, northwesterly flow into southeastern United States. The elongated Low extending from Greenland to the Great Lakes was a reflection of the daily, cold cyclones that moved along the axis of this mean Low (Chart X). A deeper than normal Low appeared in the Southwest, east of the upper level trough through California.

The geostrophic relative vorticity at 700 mb. (fig. 2) had a field which resembled the mean sea level isobaric field as noted by Klein in an early article of this series [4]. Cyclonic conditions existed in the Southwest and Northeast with a maximum center located over the Great Lakes. The upper flow was anticyclonic in the western ridge and in the Southeast.

The mean 700-mb. jet streams (fig. 3A) were located near the normal positions with one important exception. The northern branch in western North America which normally flows over Washington and Montana (see dashed line in figure 3A) was displaced 13° of latitude northward to the Yukon, from where it extended southeastward into the United States. This jet stream, which had wind speed greater than normal from the Arctic to Georgia (fig. 3B), was instrumental in advecting cold air into the Central and Eastern States at a rapid rate. The absence of a westerly jet stream over the Northwest, where wind speed averaged 3 m. p. s. below normal, had a pronounced desiccative effect on the weather in the windward areas. In the Southeast, winds were 4 m. p. s. faster than normal at the 700-mb. level. Generally in April lapse rates are steep and vertical mixing is pronounced; consequently, some of the above normal momentum at high levels may have been transported to the surface. This is attested by the strong, gusty surface winds which persisted in the Southeast. Many stations reported above normal average wind speeds and some reported damaging windstorms.

The cyclones of April traversed North America along two principal west to east tracks. One extended across central Canada and the other across central United States (fig. 4B and Chart X). The latter was closely related

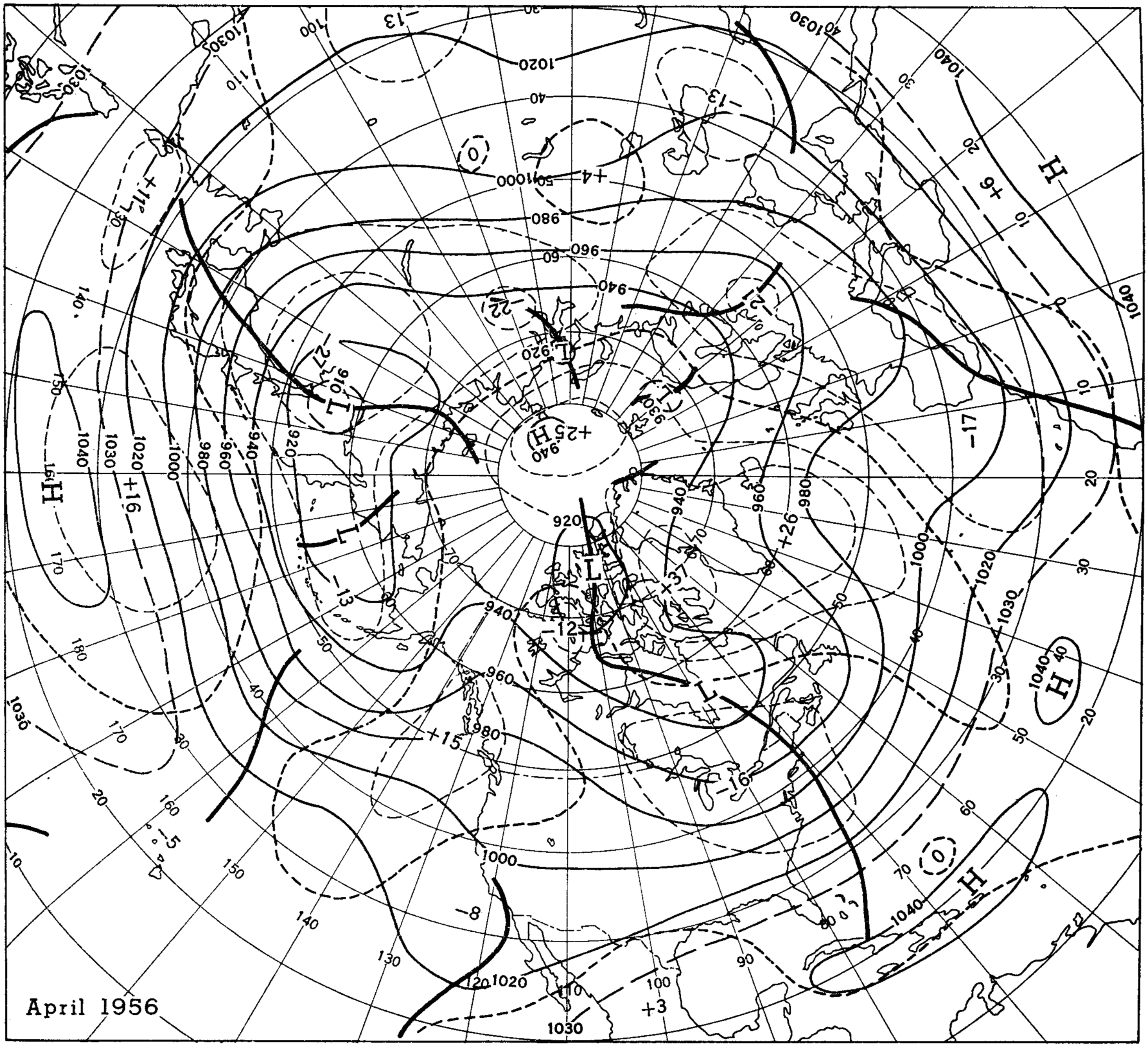

FIGURE 1.—Mean 700-mb. contours and height departures from normal (both in tens of feet) for April 1956. A strong ridge in western Canada coupled with a deeper than normal trough near the east coast of the United States resulted in a cold April. Heights were above normal in the Davis Strait—a long-period anomaly.

to the southern branch of the jet stream (fig. 3A). Much cyclonic activity occurred in the Gulf of Alaska, but only three storms crossed the western massif. One storm passed through British Columbia and Alberta, while the other two moved northeastward through the Yukon. There was a great deal of cyclogenesis in and east of the mountains. In the United States many Nevada and Colorado Lows formed and moved eastward. Early and late in April the storms moved northeastward through the Great Lakes along the preferred seasonal track. However, during the middle of the month, when blocking was most pronounced, deep storms were deflected southward in eastern United States. Knoxville, Tenn., and Vicksburg, Miss., observed new record low sea level pressures for April on the 15th. (For a detailed study of one of the Southeast storms see article by McQueen and Rammer elsewhere in this issue.) Cyclonic activity was also prevalent in the western Atlantic, just east of the mean trough.

Nearly all the anticyclones affecting the United States in April originated in western Canada and Alaska or were break-offs of cold air masses from Canada which first appeared as closed centers in the Southern Plains (fig. 4A

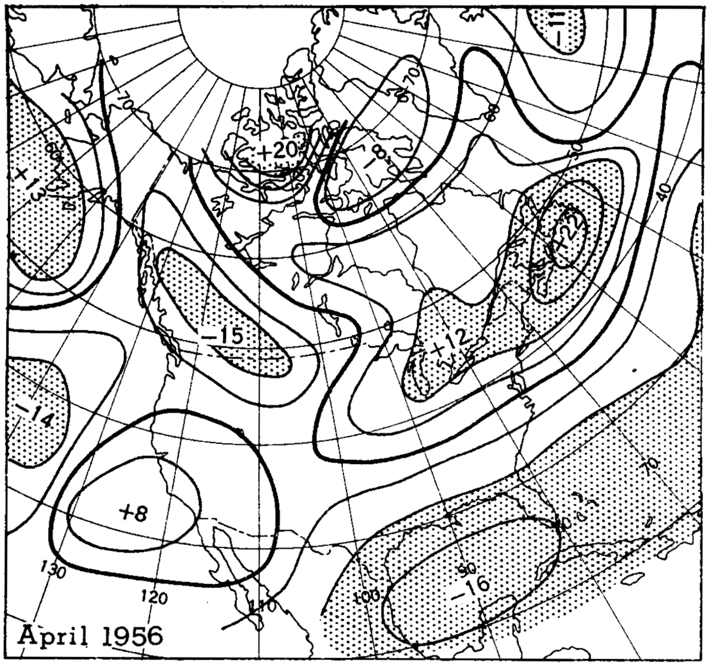

FIGURE 2.—Vertical component of the mean geostrophic vorticity at 700-mb. for April 1956, in units of 10^{-6} sec^{-1}. Cyclonic and anticyclonic vorticity considered positive and negative respectively. Absolute values greater than 10 $\times$ 10^{-6} are stippled.

and Chart IX). As indicated by their source region, these Highs were composed of cold polar air masses which dominated the Eastern States most of April. The mean thickness departure from normal (fig. 5), shows an extensive area of below normal temperature along the axis of maximum frequency of anticyclones. This testifies to the coldness of the April anticyclones both in the source region and in the United States.

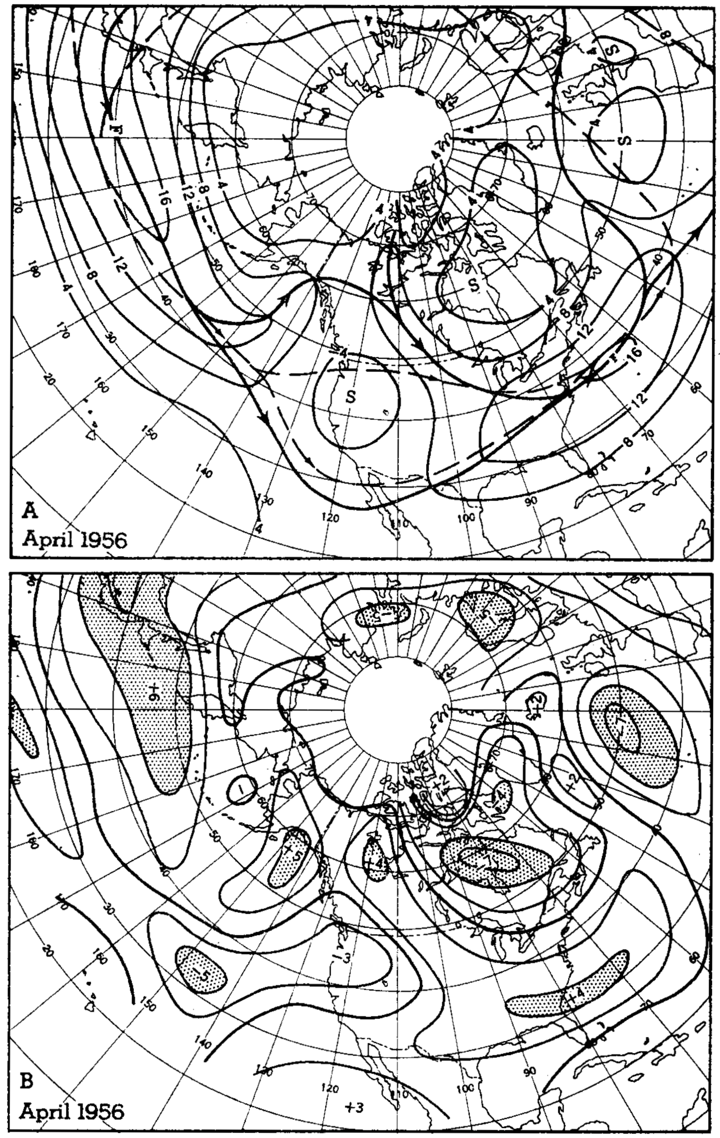

FIGURE 3.—(A) 700-mb. isotachs and (B) departure from normal wind speeds (both in meters per second) for April 1956. Solid arrows in (A) indicate positions of mean 700-mb. jet axes, and broken arrows their normal April positions. Anomaly values greater than 4 are stippled. Normal jet stream over the Northwest was displaced northward to the Yukon. Wind speeds were weak in the Northwest but strong from Alaska to Georgia.

EVOLUTION WITHIN THE MONTH

The blocking that operated in North America during April originated early in March 1956 over Scandinavia. (The March blocking action and associated weather is discussed in detail in the previous paper of this series [1].) It retrograded and weakly affected eastern Canada and the western Atlantic early in April. Five-day mean 700-mb. heights for March 31–April 4, 1956 (fig. 6A) were as much as 360 feet above normal in the Davis Strait and below normal to the south over the Atlantic. Positive height anomalies over eastern Canada have been a long-period and persistent feature of the circulation and their continued effects on the circulation and the United States weather have been emphasized in many recent papers [1, 5, 6, 7].

The strong tendency for 700-mb. height to remain above normal over the Baffin Island region this April is illustrated by the quasi-stationary nature of a 5-day mean, positive anomaly center (fig. 7) which was observed during each week of the month. One manifestation of the influence of this positive center on the circulation was the negative anomaly in eastern United States which appeared early in the month and then meandered in the vicinity of the Great Lakes until the end of April. It should be pointed out that even though 700-mb. heights persisted above normal in the Baffin Island area, there was also an almost continuous rise of heights in western Canada and Alaska. Apparently the original positive anomaly over Greenland divided, and one center remained in eastern Canada while another retrograded and infected the westerlies progressively farther upstream in a manner described by Namias [8].

It was noted at the beginning of this section that the blocking observed early in April in eastern Canada (fig.

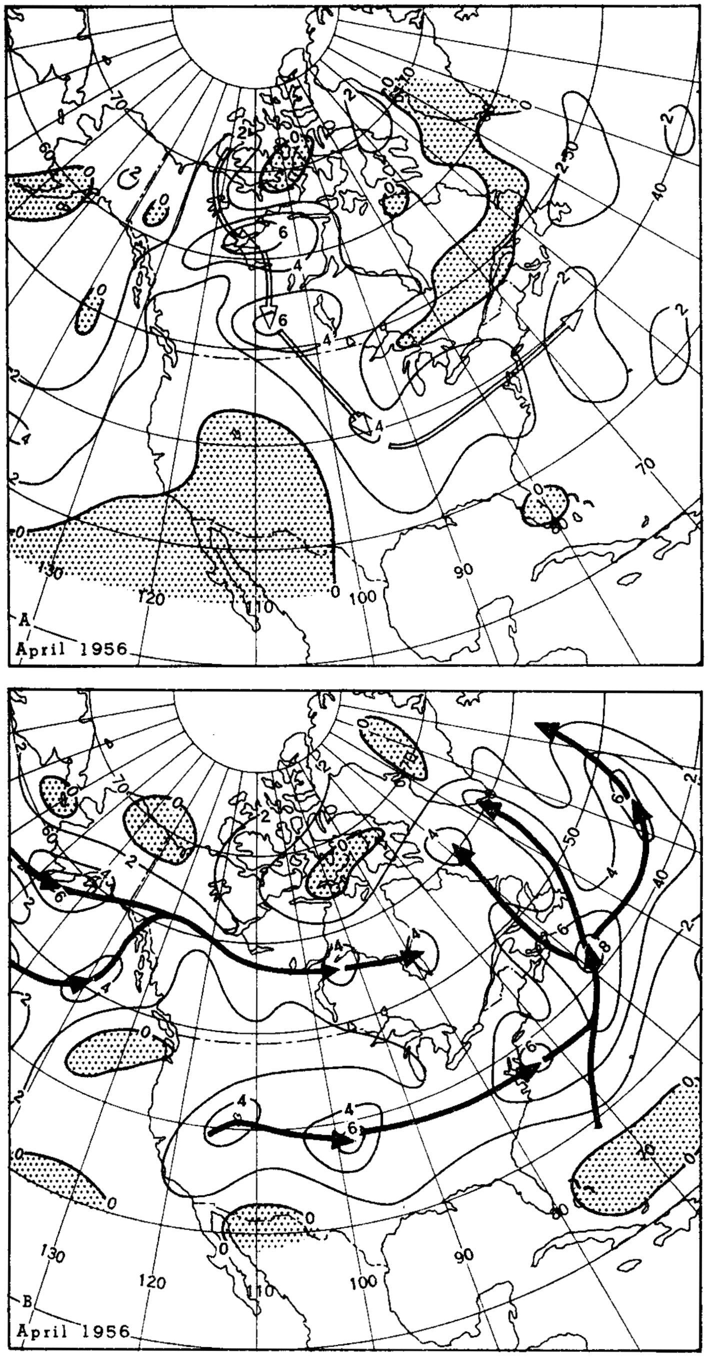

FIGURE 4.—(A) Frequency of anticyclone passages and (B) cyclone passages (within 5° squares at 45° N.) during April 1956. Zones of frequent anticyclone and cyclone passage are indicated by open and solid arrows respectively. Cold anticyclones from Canada frequently invaded the United States. Cyclones had trajectories south of normal in the East.

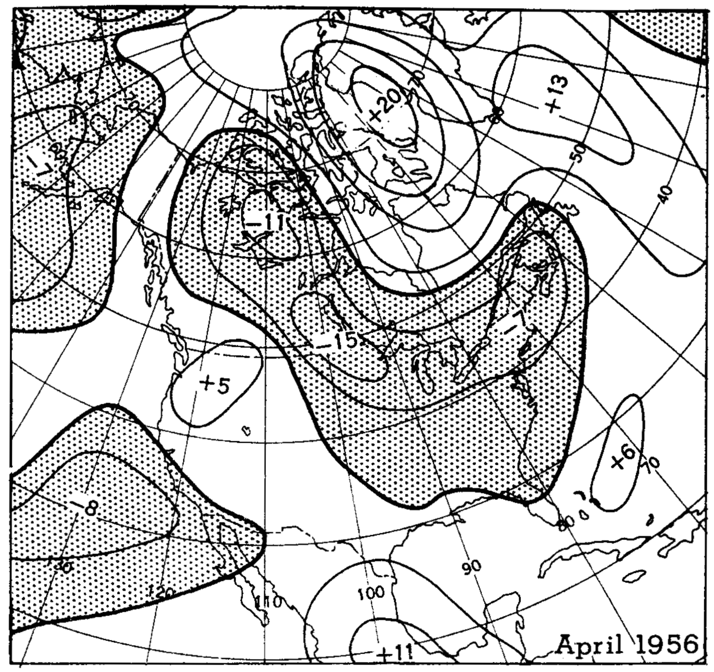

FIGURE 5.—Departure from normal of mean thickness (1000–700 mb.) for April 1956. Subnormal areas are stippled. Air masses with below normal temperatures, especially cold in the Canadian source region, spread southeastward over the United States.

6A) had retrograded from its March location. In order to illustrate the strong blocking surge that intensified during April and continued to retrograde rather slowly, a simple local blocking index was computed which essentially measures the weakness of the westerlies between 35° N. and 65° N. along a given meridian (fig. 8). In eastern North America (see the curve for 75° W.) blocking was very weak early in April and a minimum was reached around April 3. The blocking index climbed to a maximum by the middle of the month and then dropped sharply to a negative value at the end of April when fast westerly flow was dominant. This pronounced cycle was associated with a corresponding cycle of the temperature in eastern United States which will be discussed in section 3. Blocking index curves for meridians farther west, namely 125° W. and 165° W., show similar variations but with a definite time lag as the blocking wave molded the flow pattern progressively farther upstream. At 125° W. the circulation was characterized by a negative blocking index (fast westerlies) during the first week of April but by a blocking regime throughout the final weeks. The Pacific flow (see curve for 165° W.) responded approximately one week later, so that the first half of April had fast westerlies and the latter half a high blocking index. The intensification and retrogression of the blocking is also disclosed in the long-period evolution of the 5-day mean positive height anomaly in Canada (fig. 6) which was initially +360 ft. but subsequently retrograded and increased to +620 ft. at mid-month (fig. 6B) when blocking reached its peak. It continued to retrograde and weakened to +400 ft. by the end of April (fig. 6C).

In connection with this blocking phenomenon a 15-day oscillation of 700-mb. heights occurred in the United States. In the East heights were above normal at the beginning and end of the month and strongly below at mid-month (fig. 6). In the mountainous areas of the West the height of the 700-mb. pressure surface essentially oscillated from below to above normal and back to below,

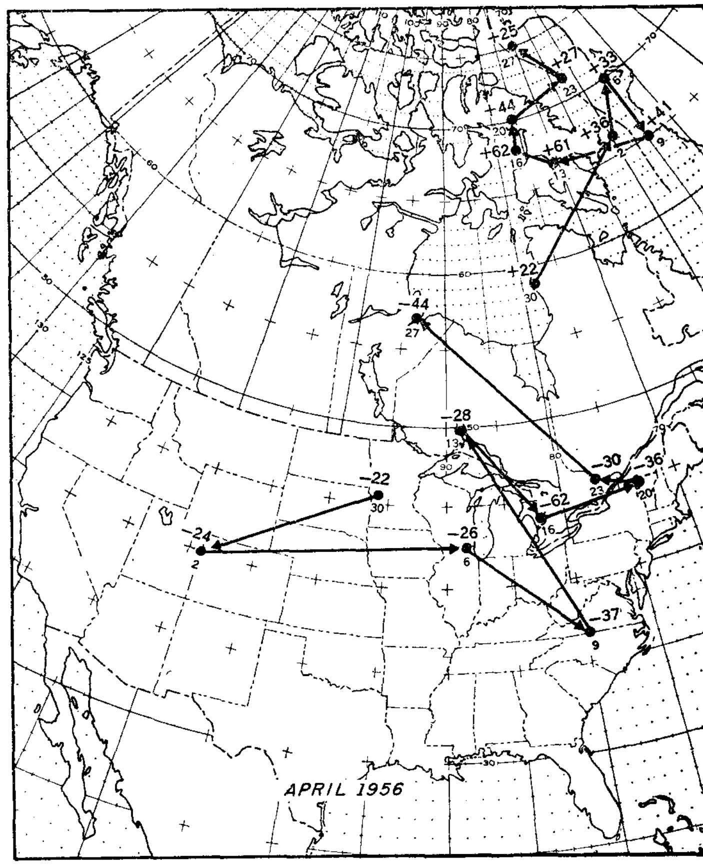

FIGURE 7.—Trajectories of two outstanding centers of 700-mb. height anomaly during April 1956. Circles locate the center of each anomaly on a series of 5-day mean charts computed twice weekly. Large, upper number is the intensity of the center in tens of feet, and small, lower number is middle date of 5-day period. (First period is centered March 30.) Positive anomalies persisted in eastern Canada and negative anomalies were prevalent in northeastern United States.

but the oscillation was not as clear-cut as in the East. Over California a cut-off, cold Low persisted and was very intense the second week of April when blocking was active in western North America.

3. WEATHER IN UNITED STATES

PRECIPITATION

The total monthly precipitation (Charts II, III) was generally plentiful east of the Mississippi River. Above normal precipitation over the Southeast occurred mainly during the first two weeks, though spotty but heavy amounts were observed along the Gulf Coast and Florida the last week. The drought in southeastern Texas was

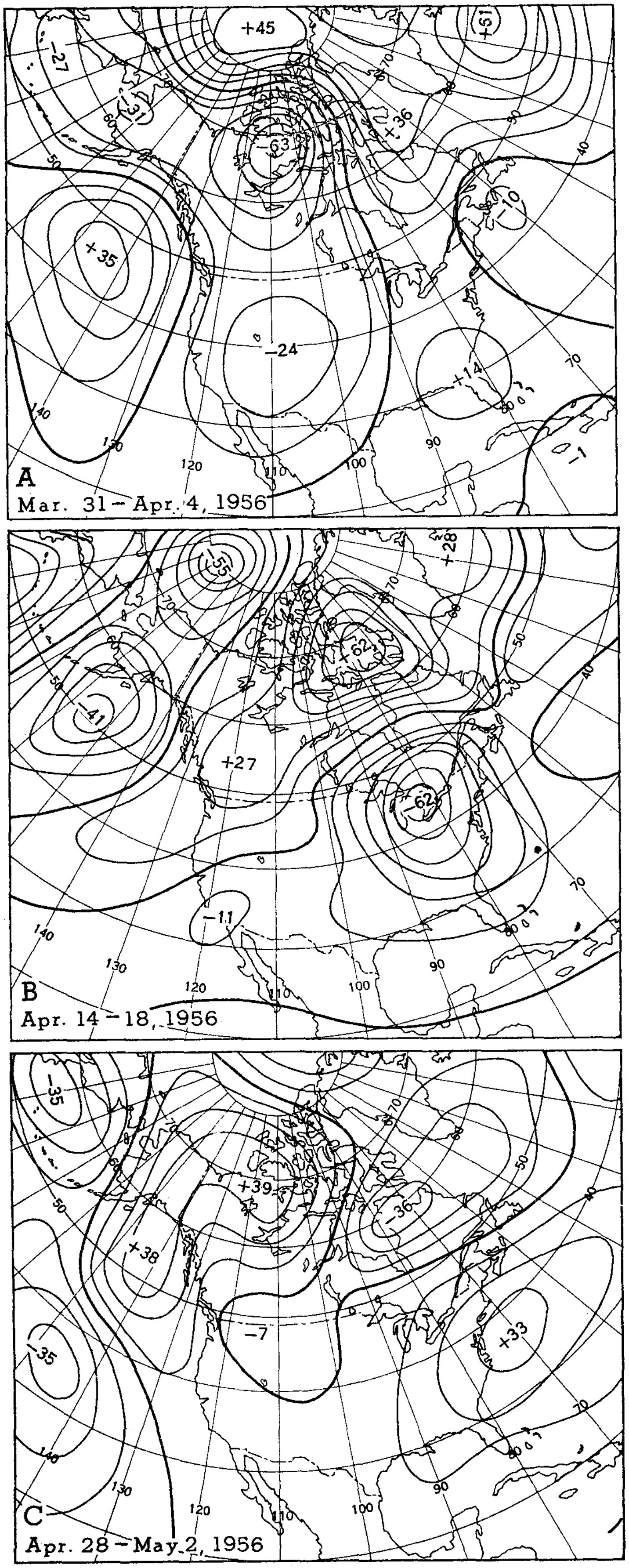

FIGURE 6.—Five-day mean 700-mb. height departures from normal in tens of feet for periods in April 1956 centered 14 days apart. Note the double oscillation of height anomaly in United States. The mid-month couplet of a positive anomaly north of a negative anomaly in eastern North America was a manifestation of the blocking action.

broken by heavy rains which produced local floods. The 4-month-old drought in Florida was alleviated in most areas. Heavy precipitation in the Great Lakes and Ohio Valley regions was observed essentially the first and last week of April, when the blocking in eastern North America was relaxed, and storms traveled northeastward through the Great Lakes. Although a monthly mean trough was not observed in this region, there was a maximum of relative vorticity over the Great Lakes (fig. 2) as well as a center of below normal sea level pressure (Chart XI, inset). Precipitation was also in excess along a narrow meridional band from southern California to western Montana. Most of the heavy precipitation in California and Nevada occurred during the second week with a small addition the final week. During the second week the cut-off, cold Low was very pronounced in the mid-troposphere. It is noteworthy, considering the late date, that 7 to 8 inches of new snowcover was reported in southern California on the 13th. Sizable amounts of precipitation fell in the northern Rockies as cold air banked against the mountains and was overrun by Pacific air. Furthermore, on the days of heavy precipitation the high-level flow was strongly cyclonic (see Daily Weather Map for 500 mb. for April 17 and 24). Total monthly precipitation at Missoula, Mont., was almost three times the normal and over 90 percent of this monthly total occurred on April 16, 17, and 24.

The far Northwest experienced a very dry month; Spokane, Wash., for example, recorded the driest April on record. The absence of the normal jet stream over Washington (fig. 3) which resulted in mean wind speeds 3 m. p. s. below normal, diminished the usual orographic precipitation. Furthermore both anticyclonic flow aloft and the absence of surface Lows approaching the coast were conducive to arid weather. In parts of Texas and New Mexico little or no precipitation fell. The drought situation was aggravated at Houston, Tex., when April became the seventh consecutive month with below normal precipitation. At Waco in central Texas it was the driest April since 1920. Other areas which suffered from continued drought were Iowa, Kansas, Missouri, and parts of Alabama and Georgia.

Snowstorms, one of the weather extremes of April, were closely associated with the blocking. Widespread snowfall totaling roughly 6 to 12 inches fell over the Northeast and through the Mid-West on the 7th and 8th. In general, the amounts were records for so late in the season. In the Northeast additional snow on the 23d and 24th combined with the earlier snowfall to give many areas the snowiest April in several years, and some stations, for example Portland, Maine, considered April 1956 one of the snowiest on record. Stations in Minnesota and Wisconsin also received a record snowfall for so late in the season on the 29th.

The connection between heavy snowstorms and blocking has previously been noted [1, 9, 10]. The necessary, cold, quasi-stationary, sea level anticyclone to the north

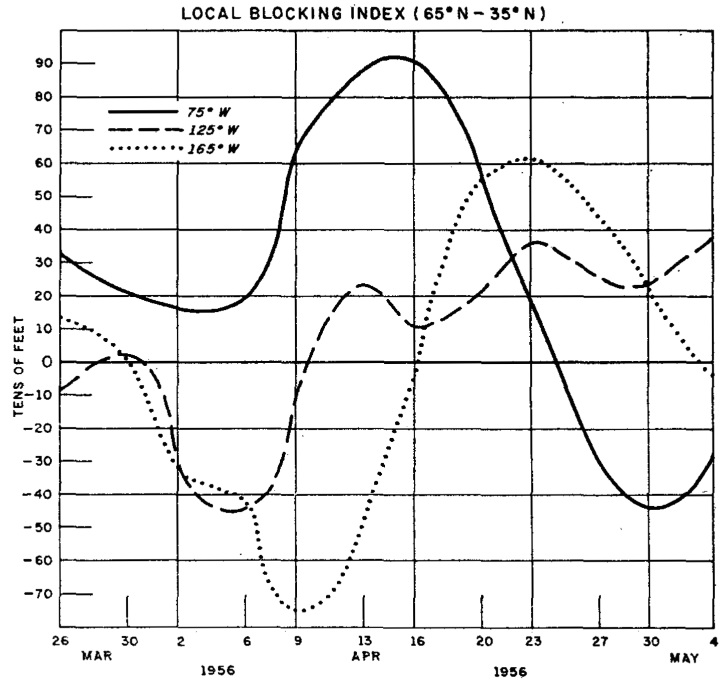

FIGURE 8.—Time variation of local blocking index in tens of feet for three meridians in the Western Hemisphere during April 1956. Index values were obtained twice weekly by subtracting the 700-mb. 5-day mean height anomaly at 35° N. from the corresponding anomaly at 65° N. Values were plotted at middle date of 5-day period. Time lag of the increase of blocking index reflects the slowly retrograding blocking surge. Large-amplitude cycle with a maximum at mid-month occurred at 75° W.

and northwest of the snow area was very pronounced on April 17, 18, and 29. (See Daily Weather Map for these dates.)

TEMPERATURE

April was essentially a cold month; temperatures averaged as low as 8° F. below normal in the extreme Northern Plains. Extremely cold periods were observed in the Southeast around the 10th and 20th and in the Northern Plains near the end of April. However, it was warmer than normal in a small area of the Northwest (Chart I). This temperature pattern is easily associated with the 700-mb. mean chart (fig. 1). Heights were below normal over most of the country except in the Northwest where the height anomaly was positive and the flow anticyclonic. Over most areas the upper flow had a stronger than normal component from the north and particularly so in the Great Plains.

Blocking action was largely responsible for cold weather during April. It operated in two rather typical ways to keep temperatures below normal. (1) When blocking was operating in eastern North America and heights of the 700-mb. pressure surface were above normal in Canada and below normal in eastern United States, the weather was cold over the eastern portion of the States, especially in the Southeast. This is similar to the relation between

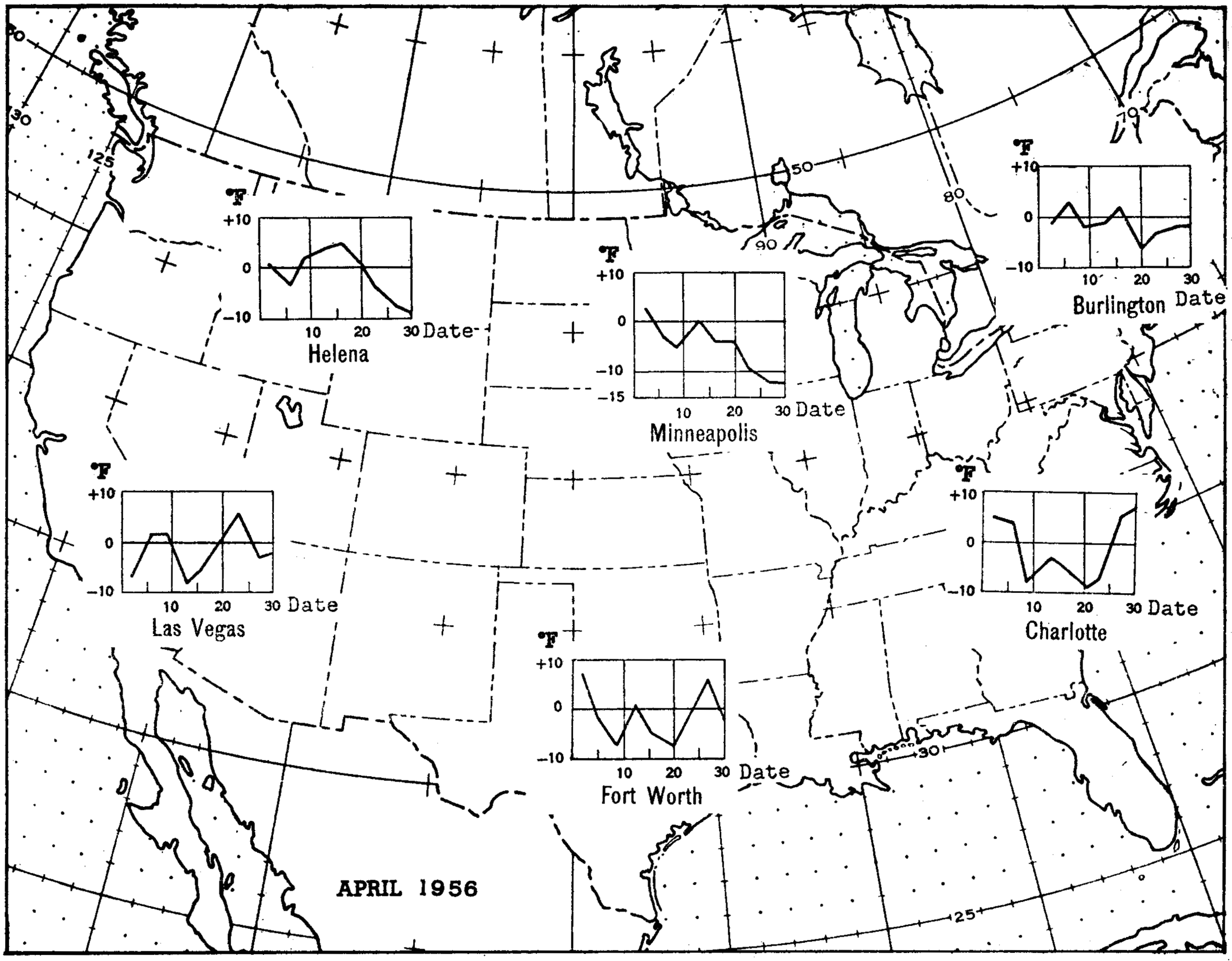

FIGURE 9.—Time variation of mean surface temperature departure from normal during April 1956 for selected stations in United States. Abscissa is the date and ordinate is the temperature departure from normal in °F. Values were obtained from 5-day mean temperatures computed twice weekly. Trends suggested at these stations, viz, warm-cold-warm at Charlotte, warm-cold at Minneapolis, cold-warm-cold at Helena, are representative of their surrounding areas.

blocking and temperature found by Rex for Europe [11]. (2) When blocking was operating farther west in Canada and the upper-level ridge over western Canada and Alaska was consequently stronger than normal, cold air was advected into the States east of the Rocky Mountains. Martin and Hawkins [12] found a large negative correlation between 700-mb. heights over western Canada and surface temperatures in the United States east of the Divide in winter.

Even though the monthly temperature average was generally below normal, there were brief warm periods. Various trends and cycles in the temperature were apparent. Graphs were therefore plotted showing the time variation of the surface temperature departure from normal for stations typical of the various areas (fig. 9).

In the Southeast (see graph for Charlotte), April started and ended warm, but the intervening period was unusually cold except for a brief warming which occurred at most stations near the 15th when warm air invaded the area ahead of the deep cyclone. The out-of-phase relation between this temperature variation and the blocking index at 75° W. (fig. 8) is striking. Daily mean temperatures were the lowest recorded in recent Aprils, and many new minima were established. Damaging frosts were common.

The Northeast (see graph for Burlington) experienced a temperature variation somewhat similar to the one in the Southeast, but because this area was located midway between the blocking High and Low, the relation between blocking and temperature was not clear cut. Some stations in the Northeast reported the coldest April since 1943 and 1944 and this month was the first April since

1950 that temperatures averaged below normal in most areas of the Northeast.

The Southern Plains and the Mid-West (see graph for Fort Worth), in proximity to the jet stream and frontal zone, underwent extreme temperature variations. For example, the daily average temperature at Kansas City, Mo., was 22° F. below normal on the 23d and 17° F. above normal on the 27th. Several maximum and minimum temperature records were broken in the Mid-West and in the Southern Plains respectively. Superimposed upon these large short-period variations was an overall cooling, in the departure from normal sense, during the month.

In the Northern Plains the almost continuous cooling trend during April is more conspicuous (see graph for Minneapolis). The first few days were spring-like, but the rest of the month was more typical of winter. As the blocking surge slowly retrograded during the month, the ridge over western Canada and Alaska intensified and cold Arctic air was advected into the United States.

The temperature trend, cool to warm to cold, in the Northwest (see graph for Helena) was generally out-of-phase with the trend in the Southeast. The temperature departure is difficult to relate to the blocking although the cold at the end of the month was definitely a consequence of the strong high-latitude ridge to the northwest.

In the Southwest (see graph for Las Vegas) the temperature was rather variable and no trends were apparent.

WEATHER HIGHLIGHTS

Many of the weather heterogeneities of April have already been mentioned. However, typical reports of interesting phenomena from the various areas of the United States have been tabulated in brief form in tables 1–4. The extreme cold, late snowstorms, and windy weather have already been emphasized. It should further be pointed out that the high winds combined with the arid condition in the Southern Plains to produce some severe duststorms. For example, a duststorm caused complete darkness at 2:30 p. m. local time April 2 at Midland, Tex. The first part of April experienced a large number of tornadoes and severe storms, but as cold air flooded the eastern half of the country and the trough stagnated off the east coast, conditions became unfavorable for severe storms and only a few were reported. Late in the month maritime tropical air returned to the Southeast and another outbreak of severe storms occurred. Early, unofficial reports of the number of tornadoes in the United States by weeks are: April 2–8, 71; April 9–15, 15; April 16–22, 0; April 23–29, 22. The days with greatest severe local storm activity were April 2, 3, 14, 15, and 28. The tornadoes of April 2 and 3 are discussed in an article by Hanks and Neubrand elsewhere in this issue.

REFERENCES

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TABLE 1.—*Floods and droughts of April 1956*

Station	Number of consecutive months with below normal precipitation	Total monthly precipitation (inches)	Remarks
Corpus Christi, Tex.		*8.04	New April record.
Fort Worth, Tex.		3.12	Heavy rains on 29th and 30th ended drought.
Lakeland, Fla.	4	3.26	Drought alleviated.
Pendleton, Oreg.		.01	Driest April on record.
Spokane, Wash.		.08	Do.
Waco, Tex.		.65	Driest April since 1920.
Key West, Fla.		.12	Driest April on record.
Des Moines, Iowa	7	.30	Drought extended.
Houston, Tex.	7	1.84	Do.
Columbia, Mo.	6	2.25	Past 6 months driest on record.

*At Corpus Christi 7.19 inches of rain on the 23d caused extensive flooding.

TABLE 2.—*Major snowstorms of April 1956*

Station	Dates	Remarks
Concord, N. H.	8, 23	April snowfall greatest since 1933.
Portland, Maine	7, 8, 23	One of snowiest Aprils on record.
Binghamton, N. Y.	7, 8, 23	Greatest April snowfall since 1943.
Scranton, Pa.	7, 8, 23	Second greatest April snowfall.
Trenton, N. J.	8, 23	April snowfall greatest since 1924.
Dodge City, Kans.	8, 9	One of the heaviest snows for so late in season.
Atlantic City, N. J.	24	Latest snowfall in 73 years of record.
Rochester, Minn.	29	Late season record snow.
La Crosse, Wis.	29	4½ inches of snow.
Akron, Ohio	7, 8, 17, 23, 24	April snowfall greatest since 1924, 4 times the average for past 10 years.
Milford, Utah	1, 2, 13	Heaviest April snowfall since 1931.
Tucson, Ariz.	2	First measurable snowfall in April since 1895.

TABLE 3.—*Surface wind phenomena and duststorms of April 1956*

Station	Date	Wind speed (m. p. h.)	Remarks
Victoria, Tex.	15	51	Highest gust reported.
Atlanta, Ga.	15	68	Fastest mile.
Columbus, Ga.	15		Widespread damage due to high winds.
Knoxville, Tenn.	15	69	Fastest mile.
Mobile, Ala.	10	58	High winds, minor damage.
Toledo, Ohio	3	72	Peak gust of 84 m. p. h. caused much damage.
Roanoke, Va.	7		Severe windstorm with hail.
Richmond, Va.			Windiest April since 1943.
Oak Ridge, Tenn.			Highest average windspeed on record (7.7).
Jacksonville, Fla.			Highest average windspeed in 23 years (10.6).
Midland, Tex.	2		Duststorm caused complete darkness at 2:30 p. m.
San Antonio, Tex.	3, 9		Dust on several other days.
Roswell, N. Mex.	2	65	Worst duststorm of season.

TABLE 4.—*New temperature records made in April 1956*

Station	Date	Maximum (° F.)	Minimum (° F.)	Remarks
Concord, N. H.				Coldest April since 1944.
Burlington, Vt.				Coldest April since 1950.
Frederick, Md.				Coldest April since 1943.
Providence, R. I.	13		26	Record for this date.
Newark, N. J.	21		32	Do.
Harrisburg, Pa.	25		30	Late season minimum.
Raleigh, N. C.	21		28	Do.
Fargo, N. Dak.	28		16	Record for this date.
Rochester, Minn.	30		11	Late season minimum.
La Crosse, Wis.	30		17	Do.
Springfield, Ill.	23		23	Record for this date.
Wichita Falls, Tex.	11		31	Late season minimum.
Walla Walla, Wash.	6		31	Record for this date.
Dallas, Tex.	11		38	Do.
	27	88		Do.
Charlotte, N. C.	21		31	Late season minimum.
	30	89		Record for this date.
Chattanooga, Tenn.	19		20	Do.
	28	88		Do.
Richmond, Va.	4	86		Do.
Miami, Fla.	7	93.4		Early season maximum.
Dodge City, Kans.	26	94		Record for this date.

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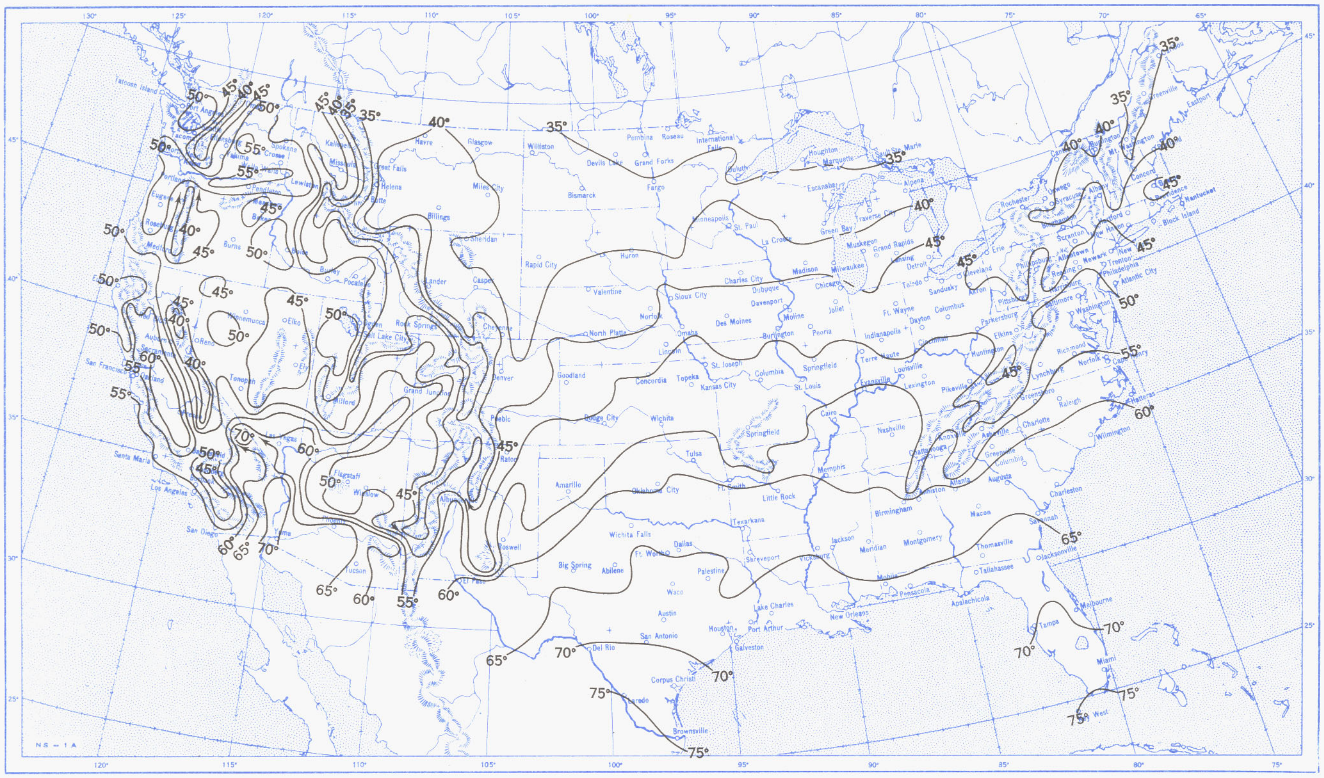
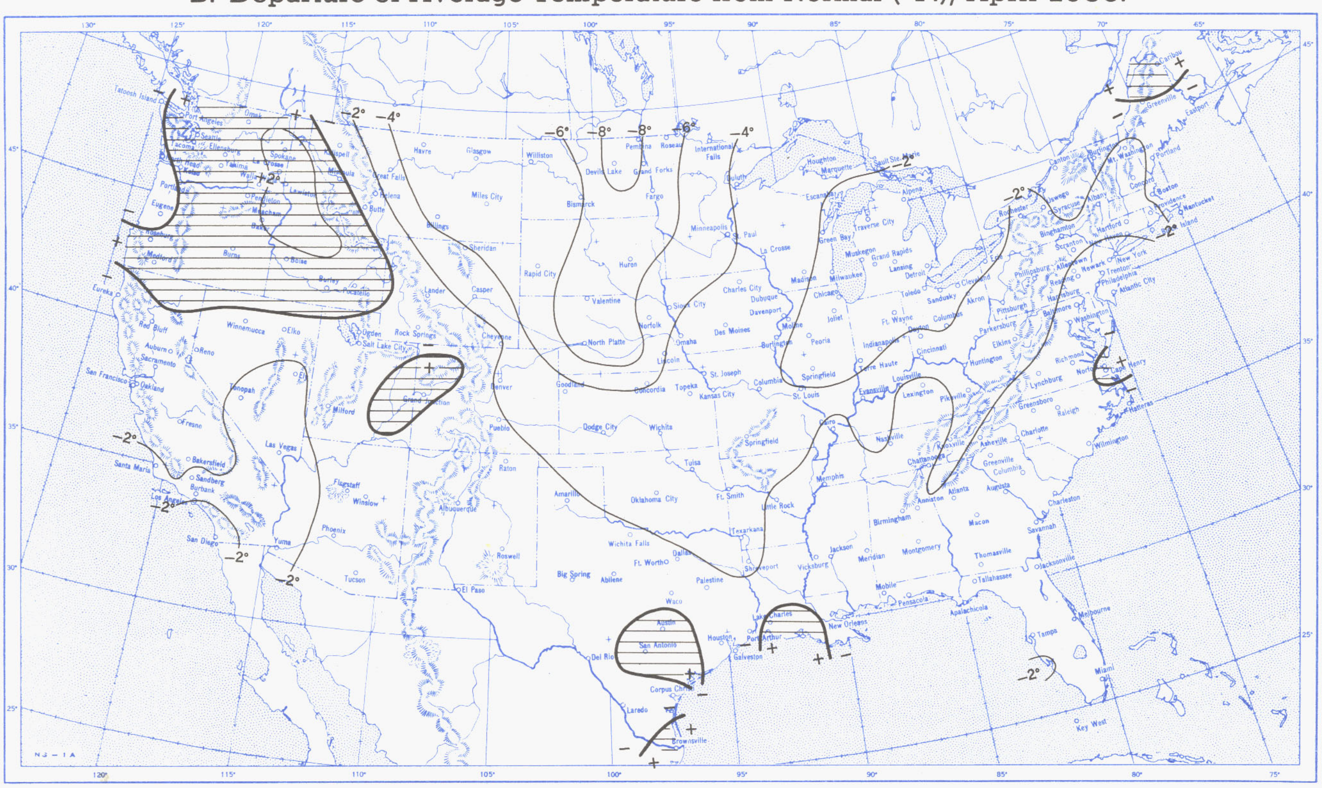
Chart I. A. Average Temperature (°F.) at Surface, April 1956.

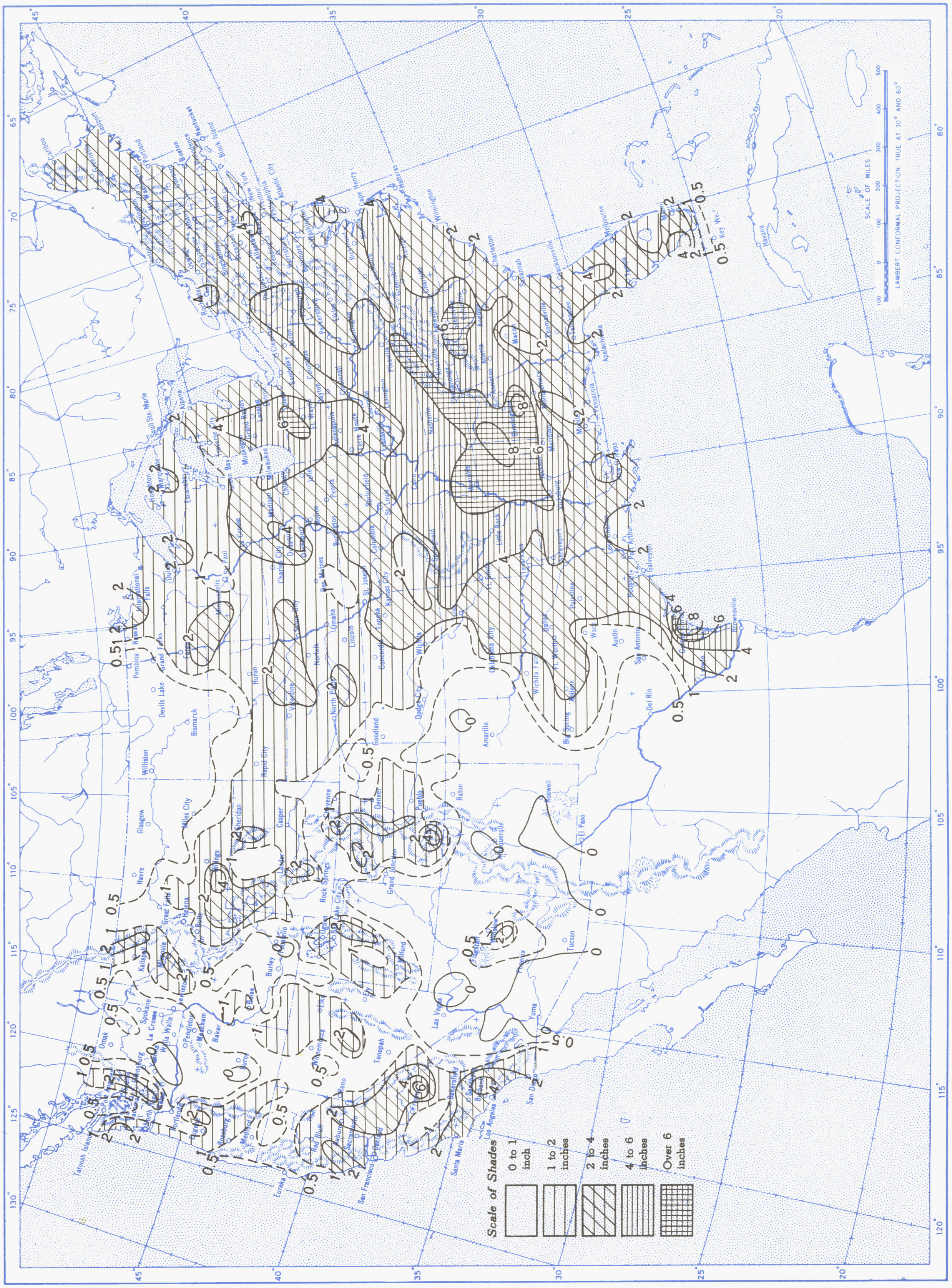


B. Departure of Average Temperature from Normal (°F.), April 1956.



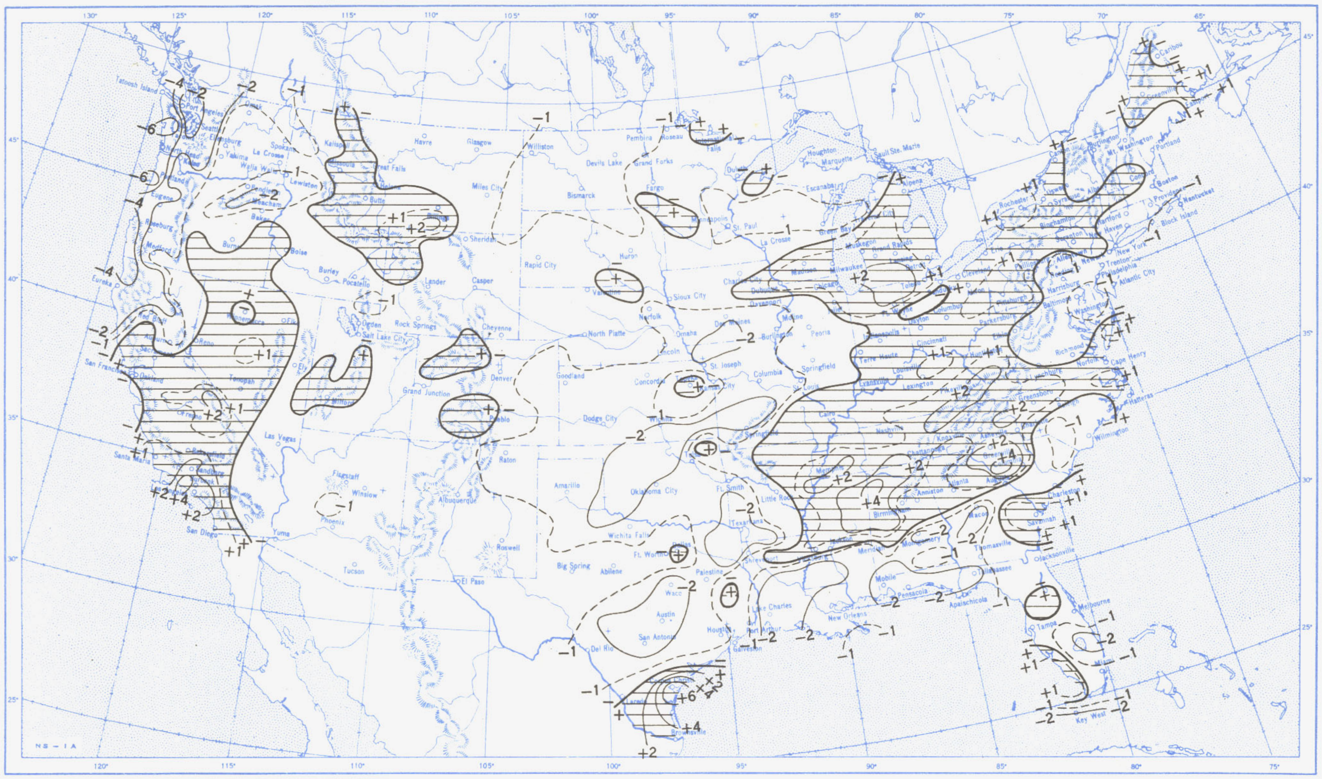
A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

Chart II. Total Precipitation (Inches), April 1956.

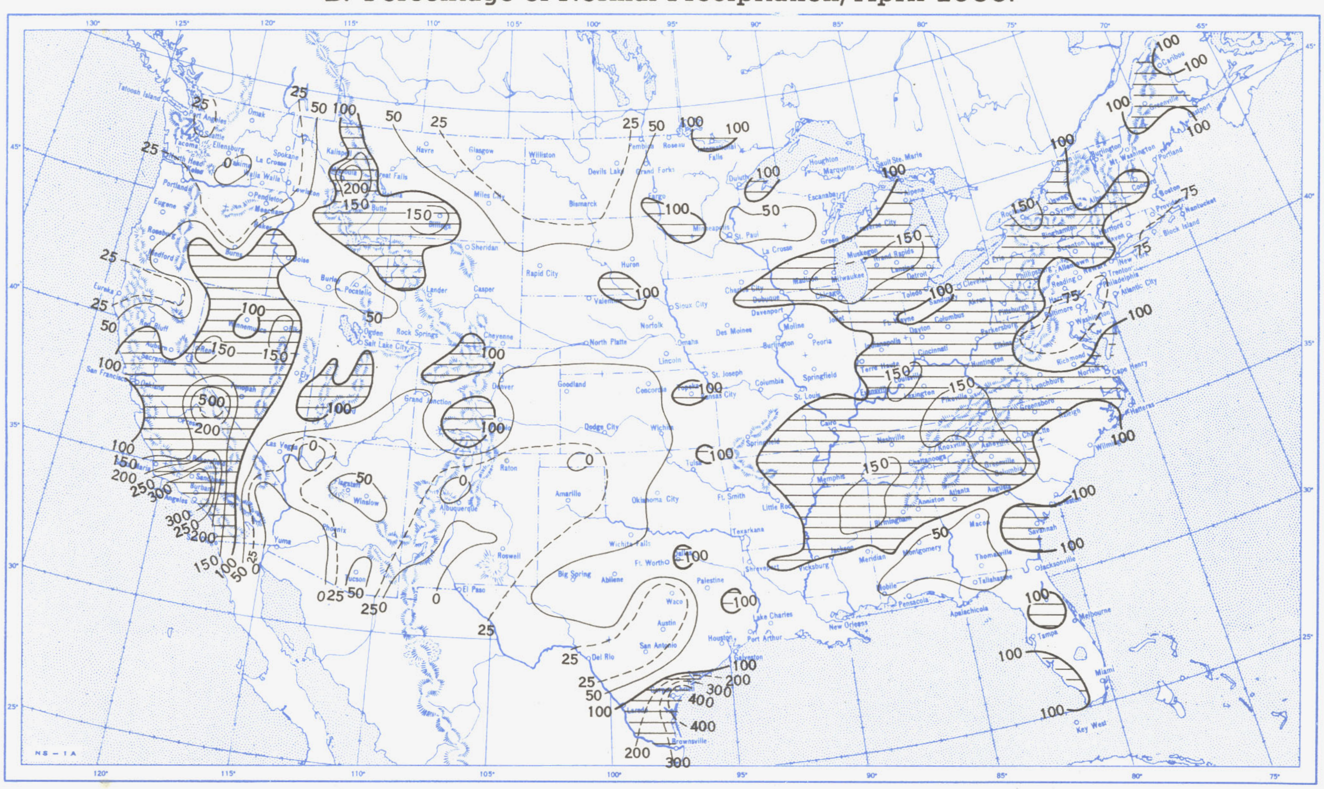


Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), April 1956.

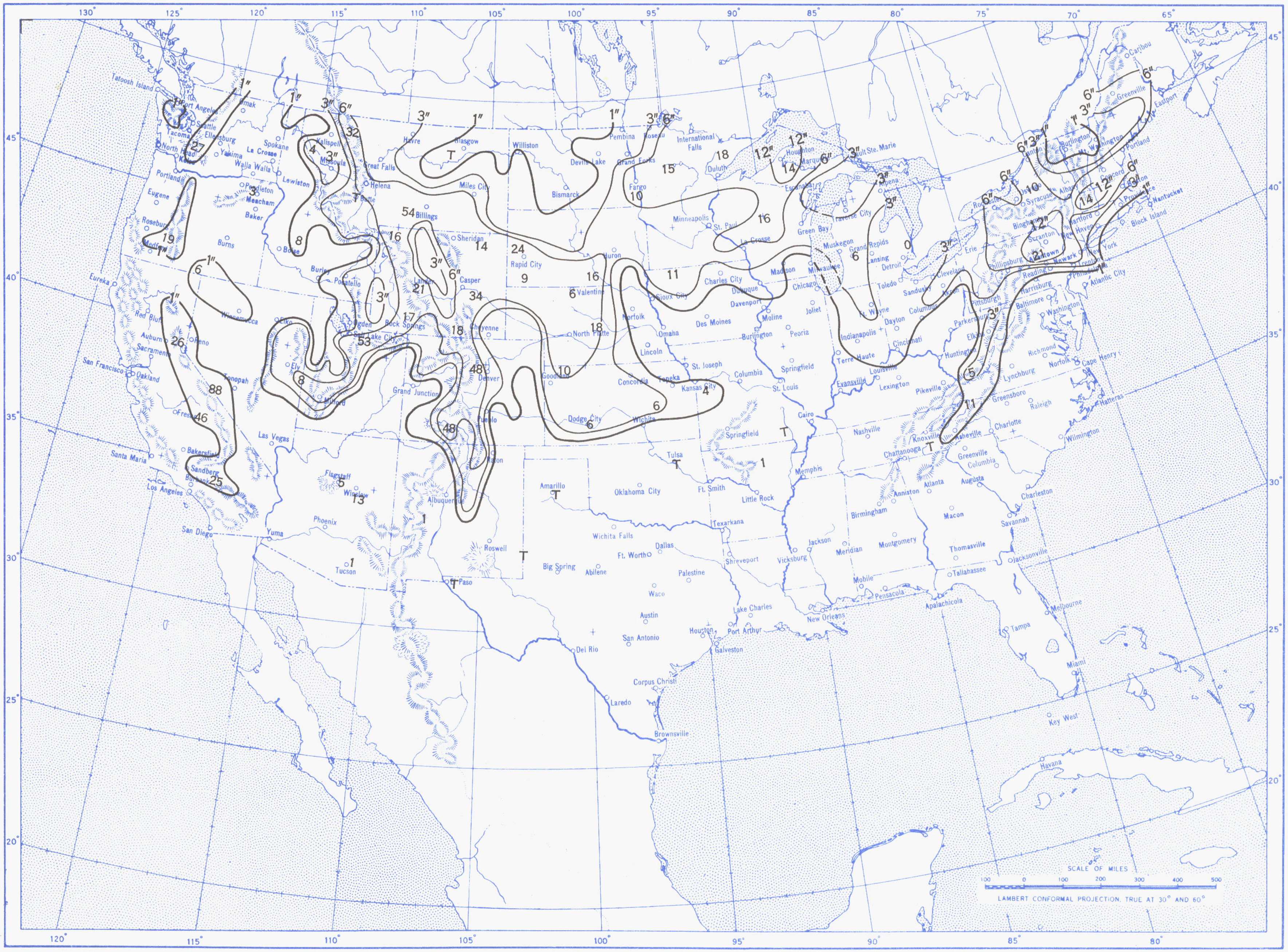


B. Percentage of Normal Precipitation, April 1956.



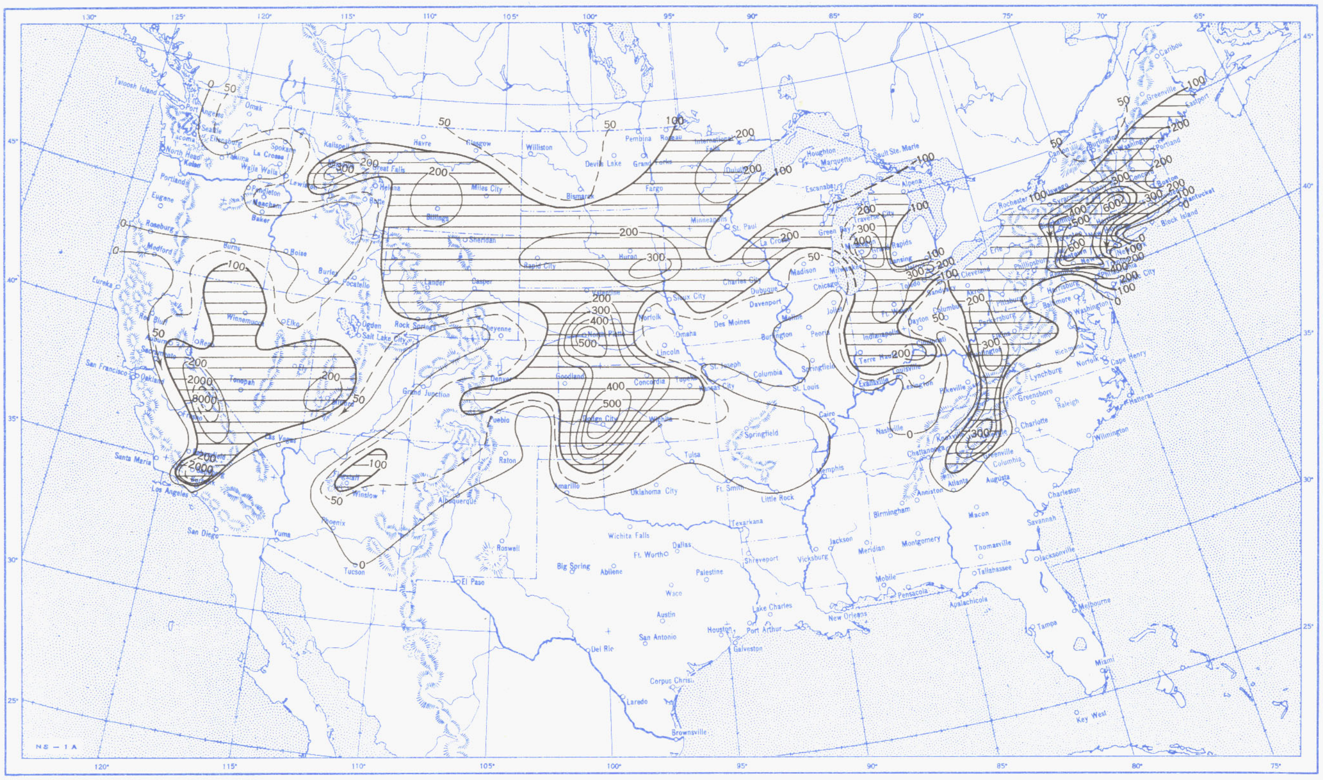
Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart IV. Total Snowfall (Inches), April 1956.



This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in the year.

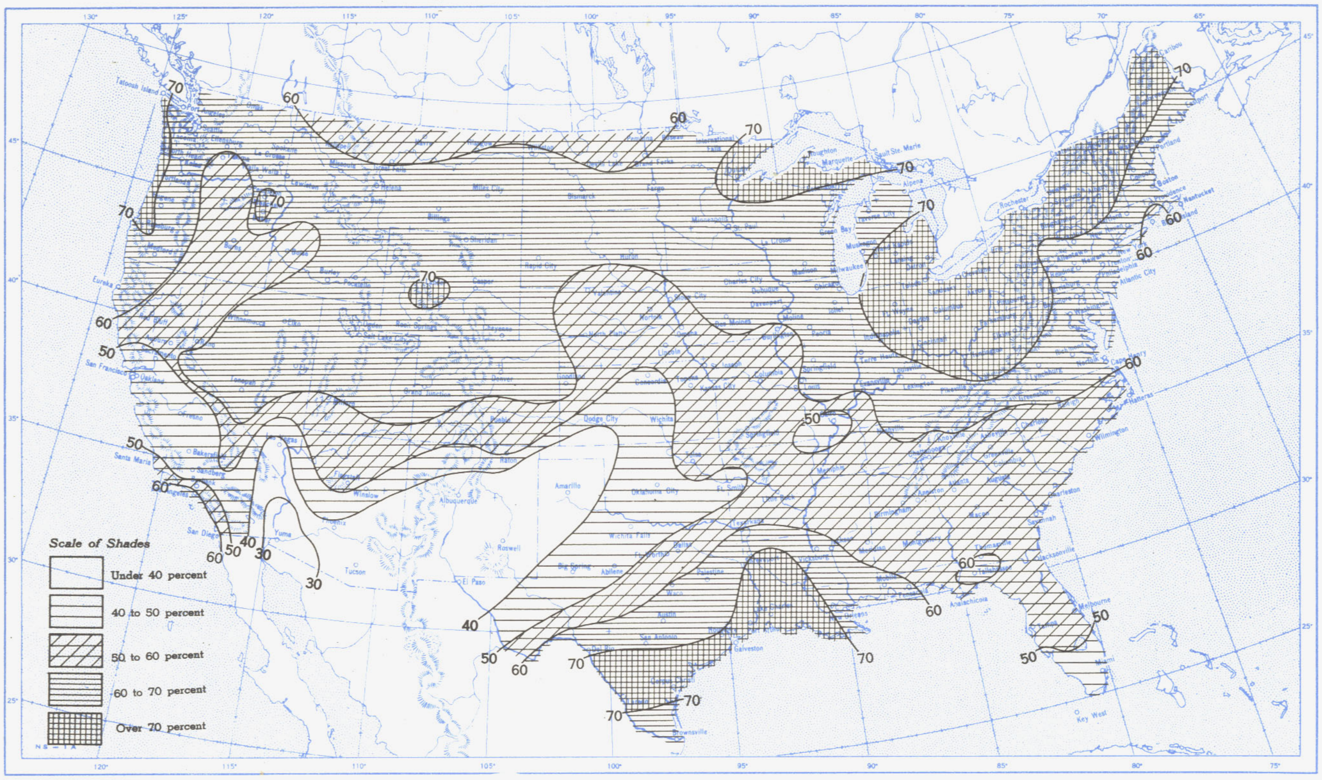
Chart V. A. Percentage of Normal Snowfall, April 1956.



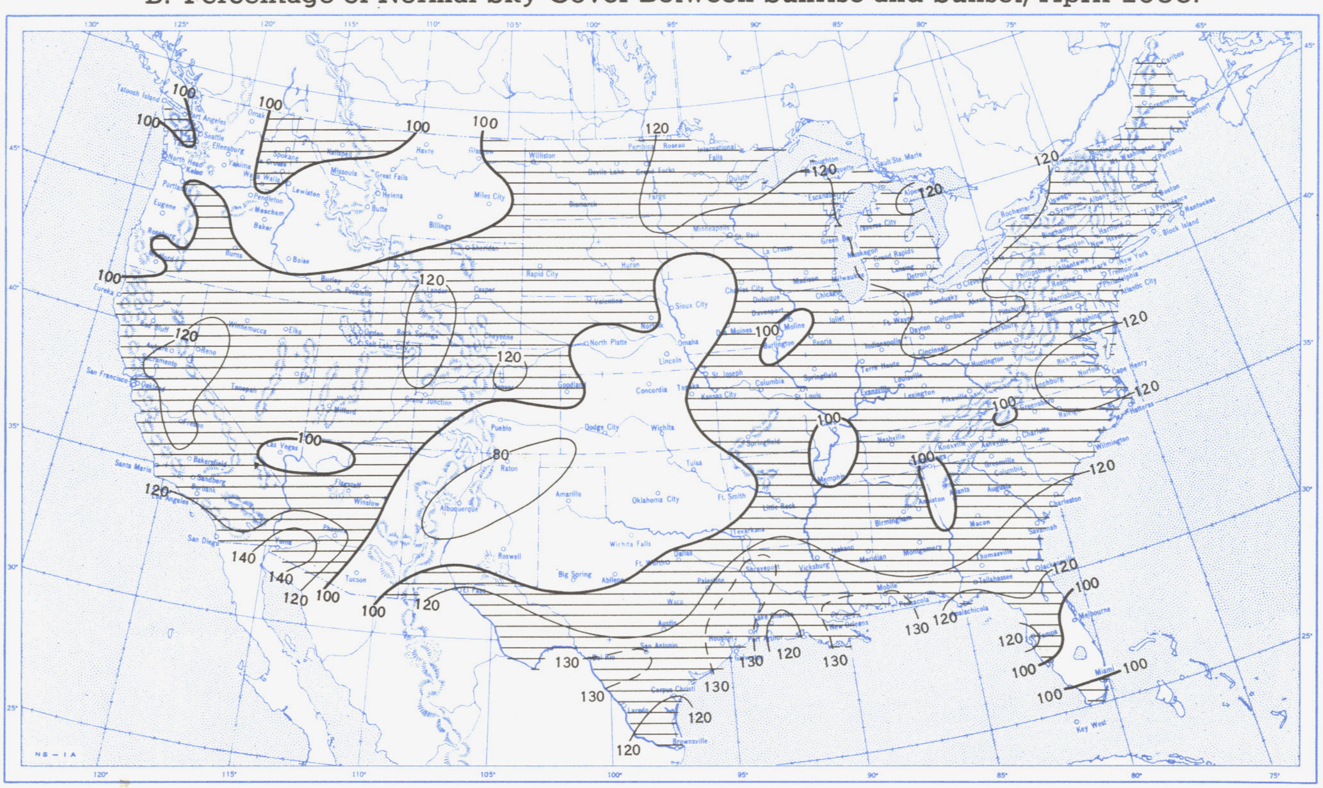
B. Depth of Snow on Ground (Inches). 7:30 a. m. E. S. T., April 30, 1956.

A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:30 a. m. E. S. T., of the Tuesday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, April 1956.

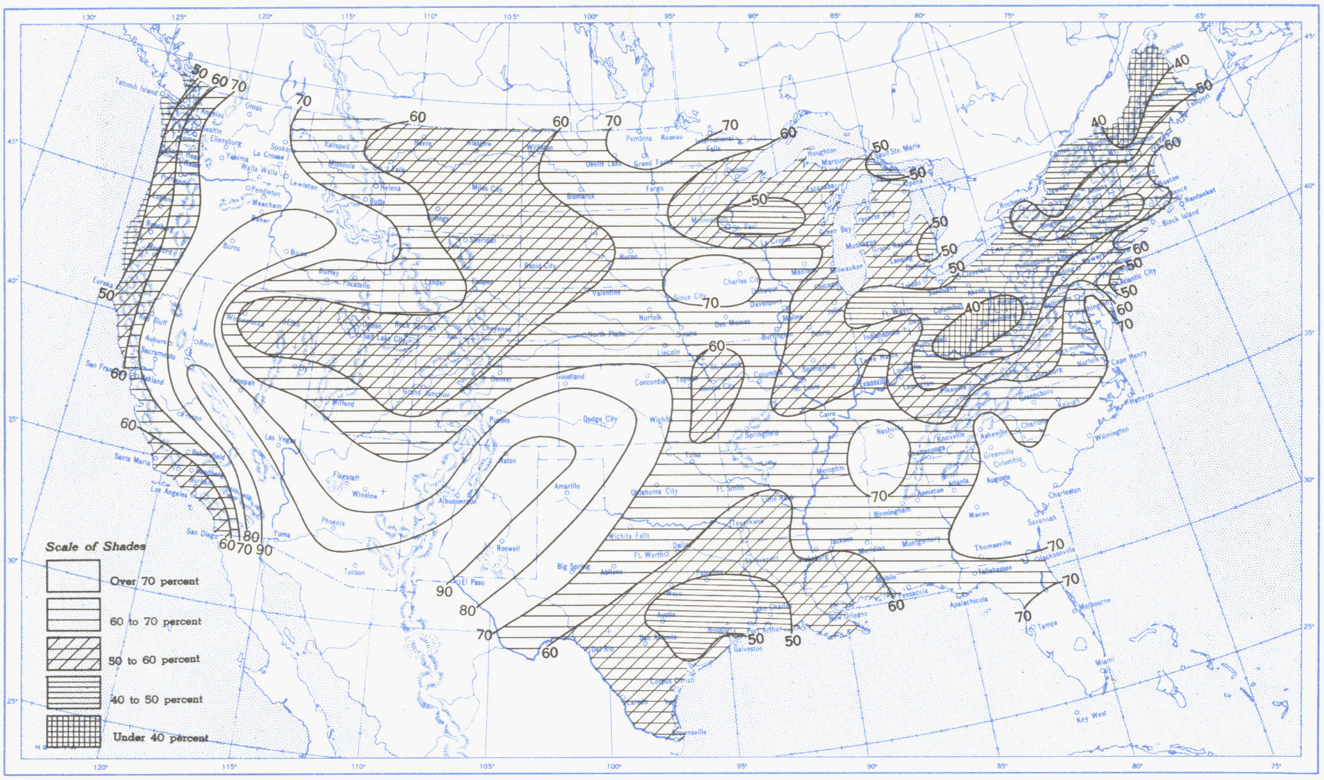


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, April 1956.

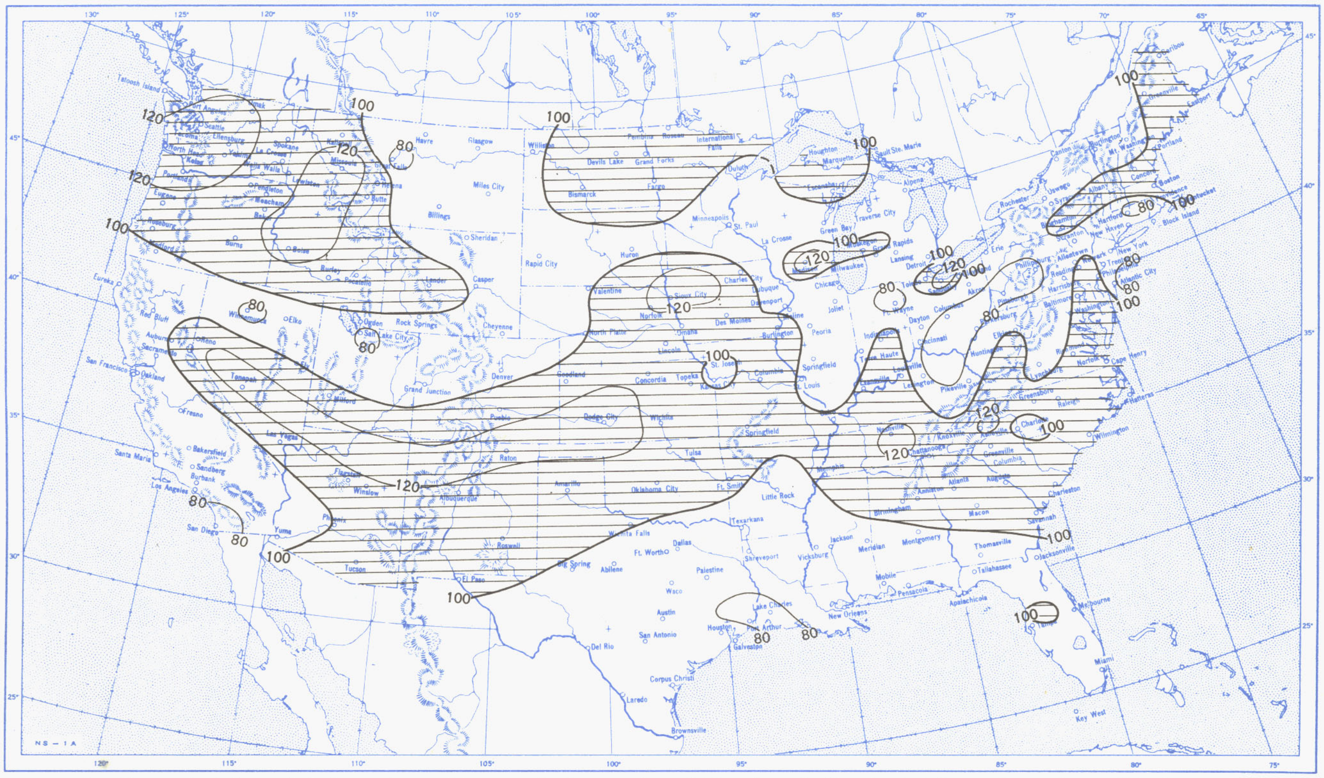


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, April 1956.



B. Percentage of Normal Sunshine, April 1956.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, April 1956. Inset: Percentage of Mean Daily Solar Radiation, April 1956. (Mean based on period 1951-55.)

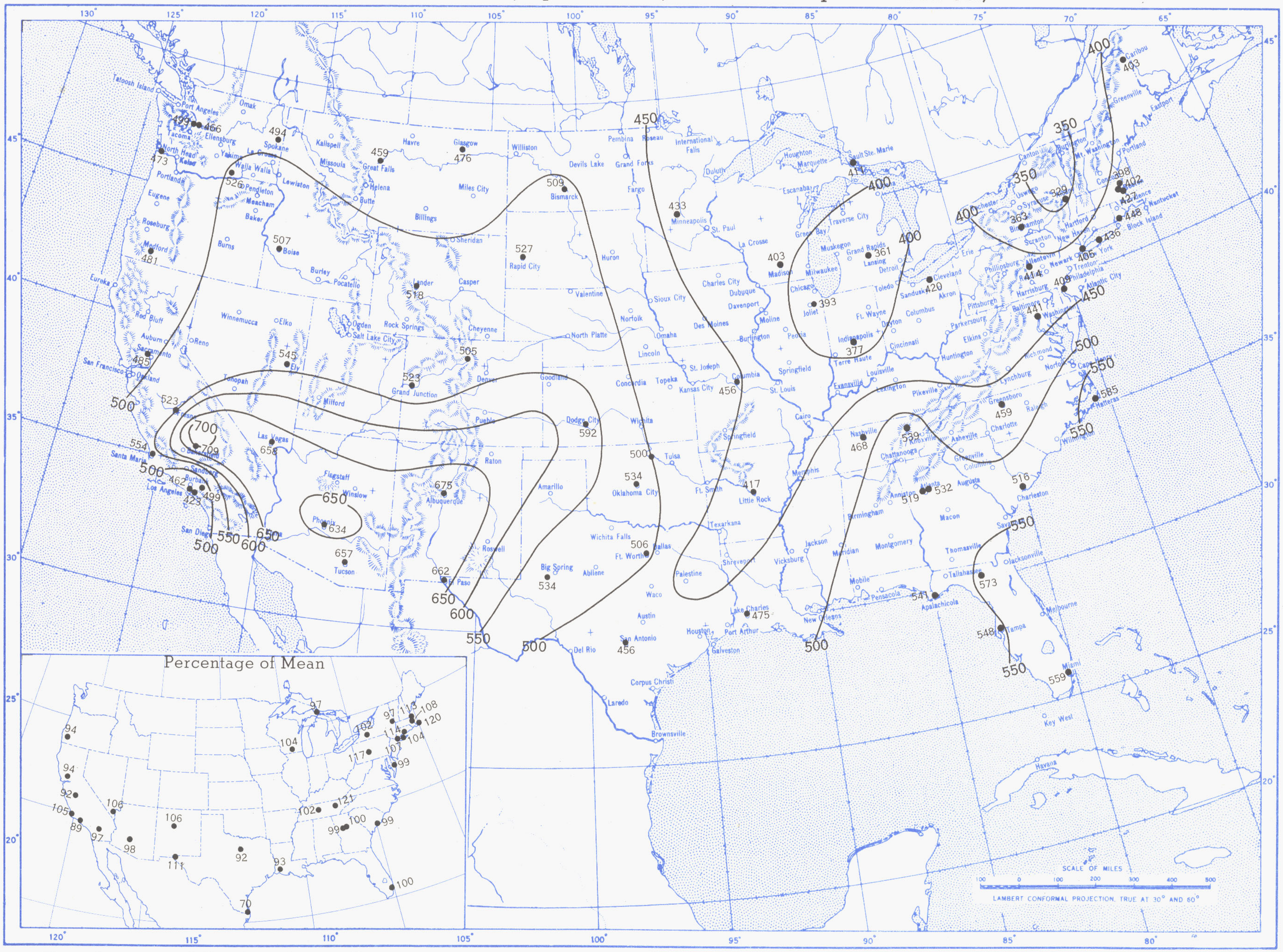
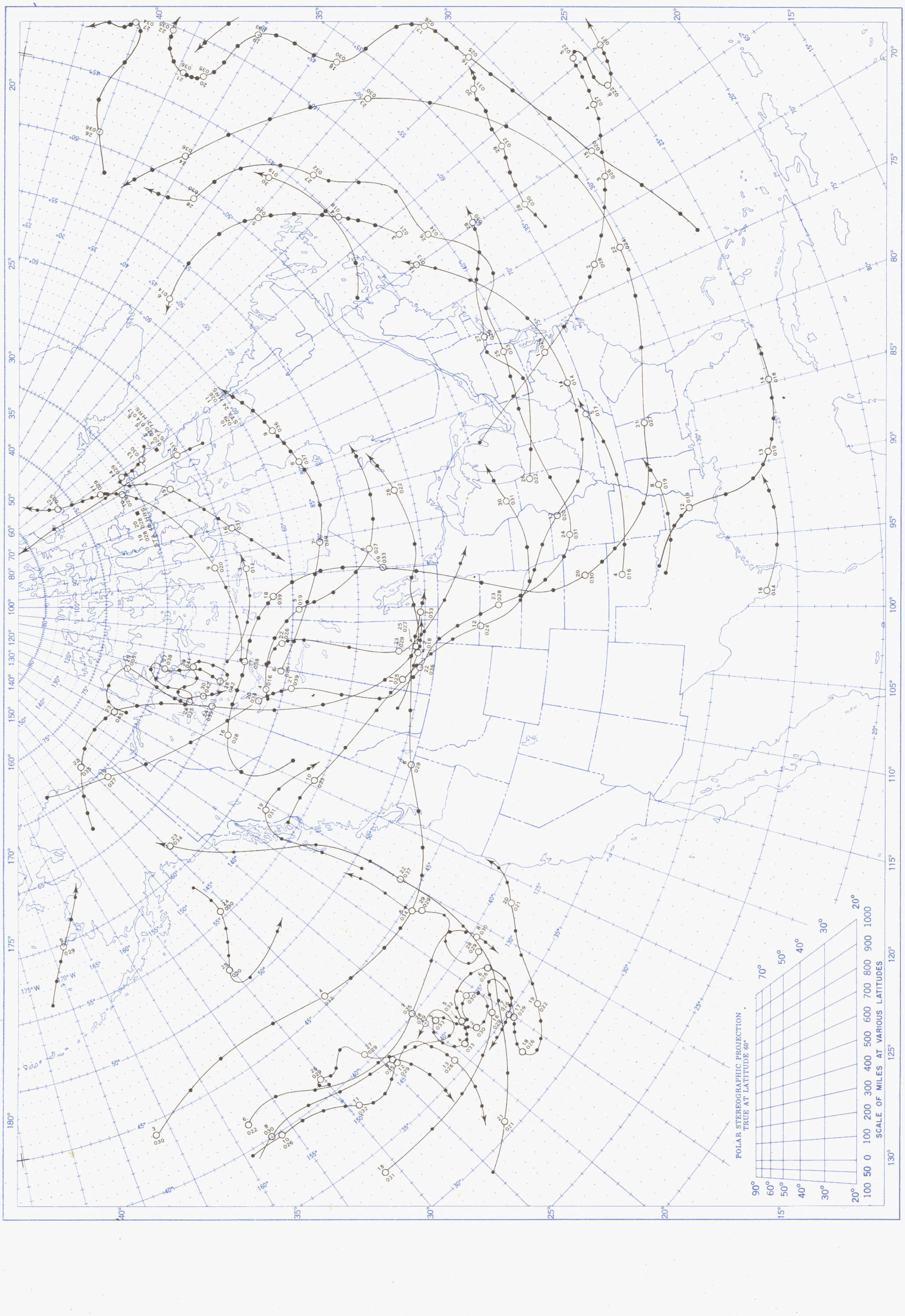


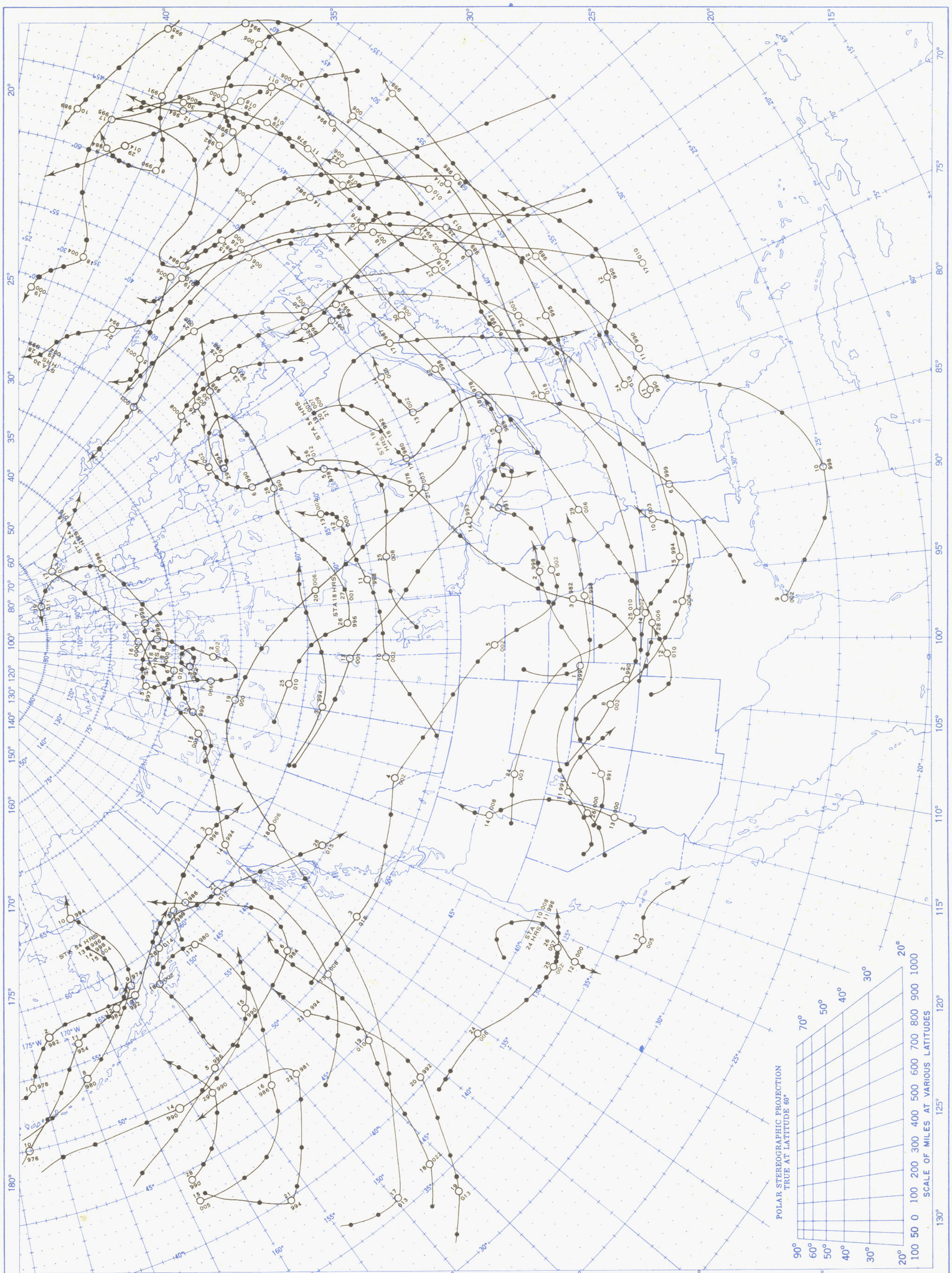
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm.$^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, April 1956.



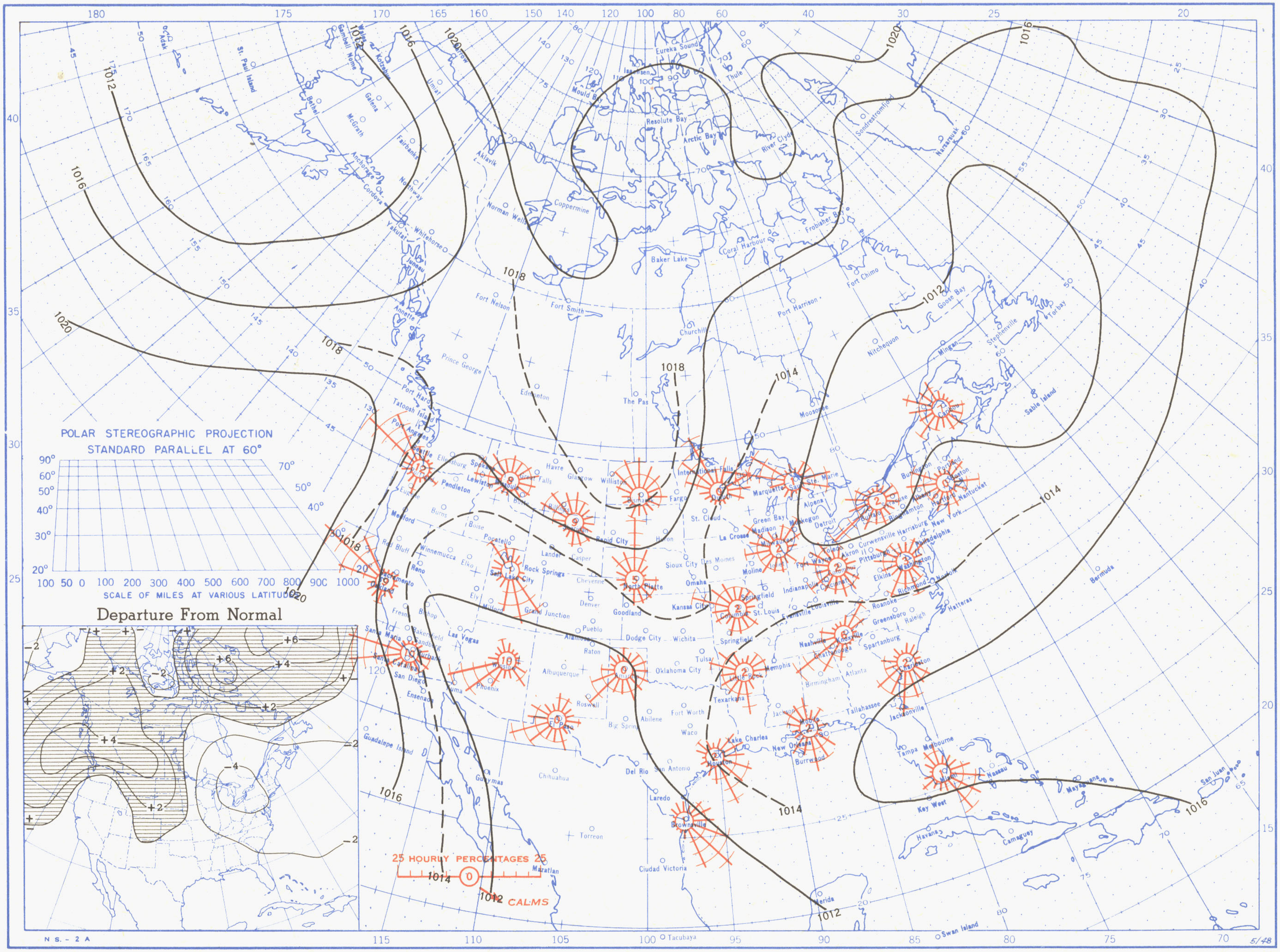
Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, April 1956.



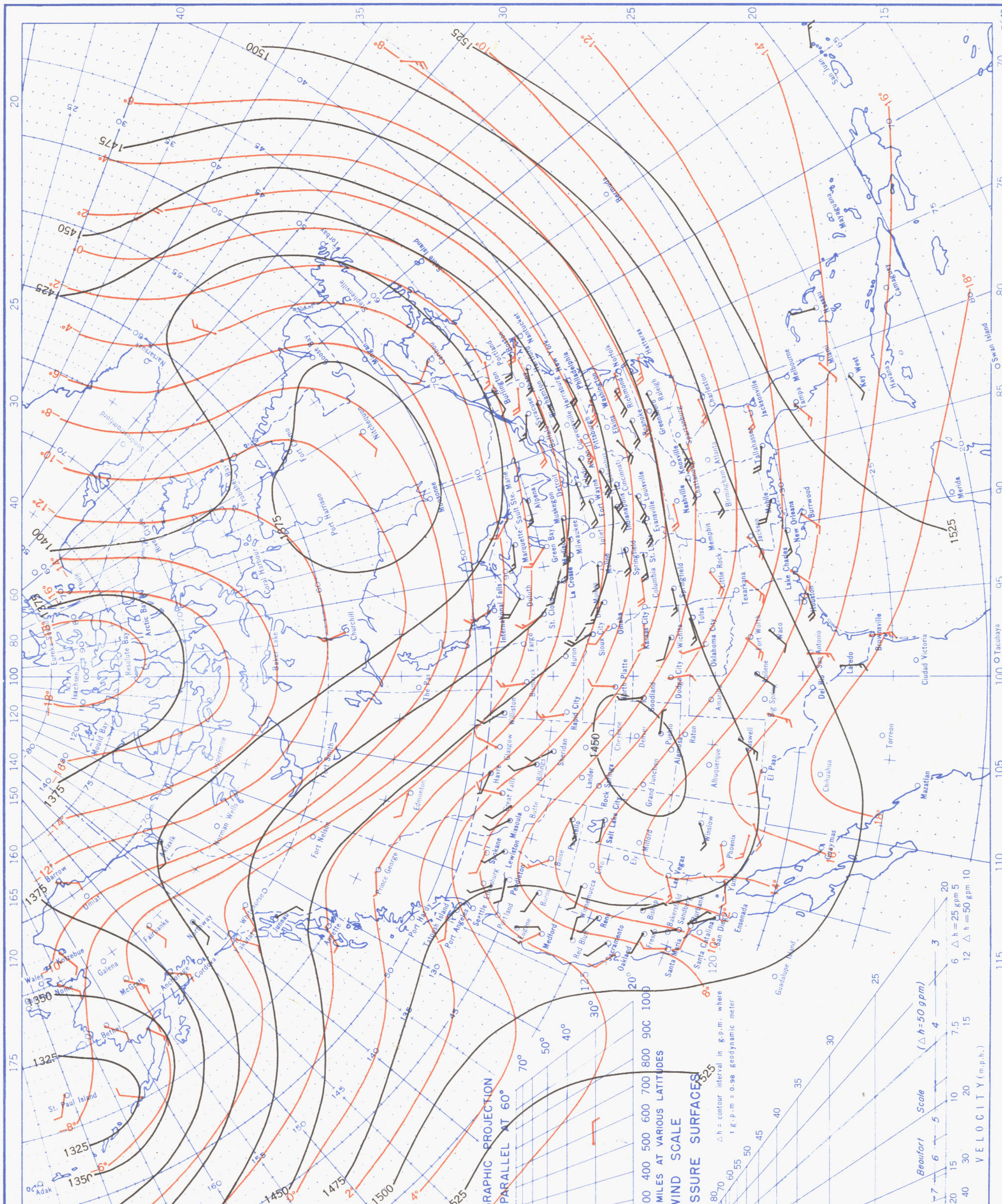
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, April 1956. Inset: Departure of Average Pressure (mb.) from Normal, April 1956.



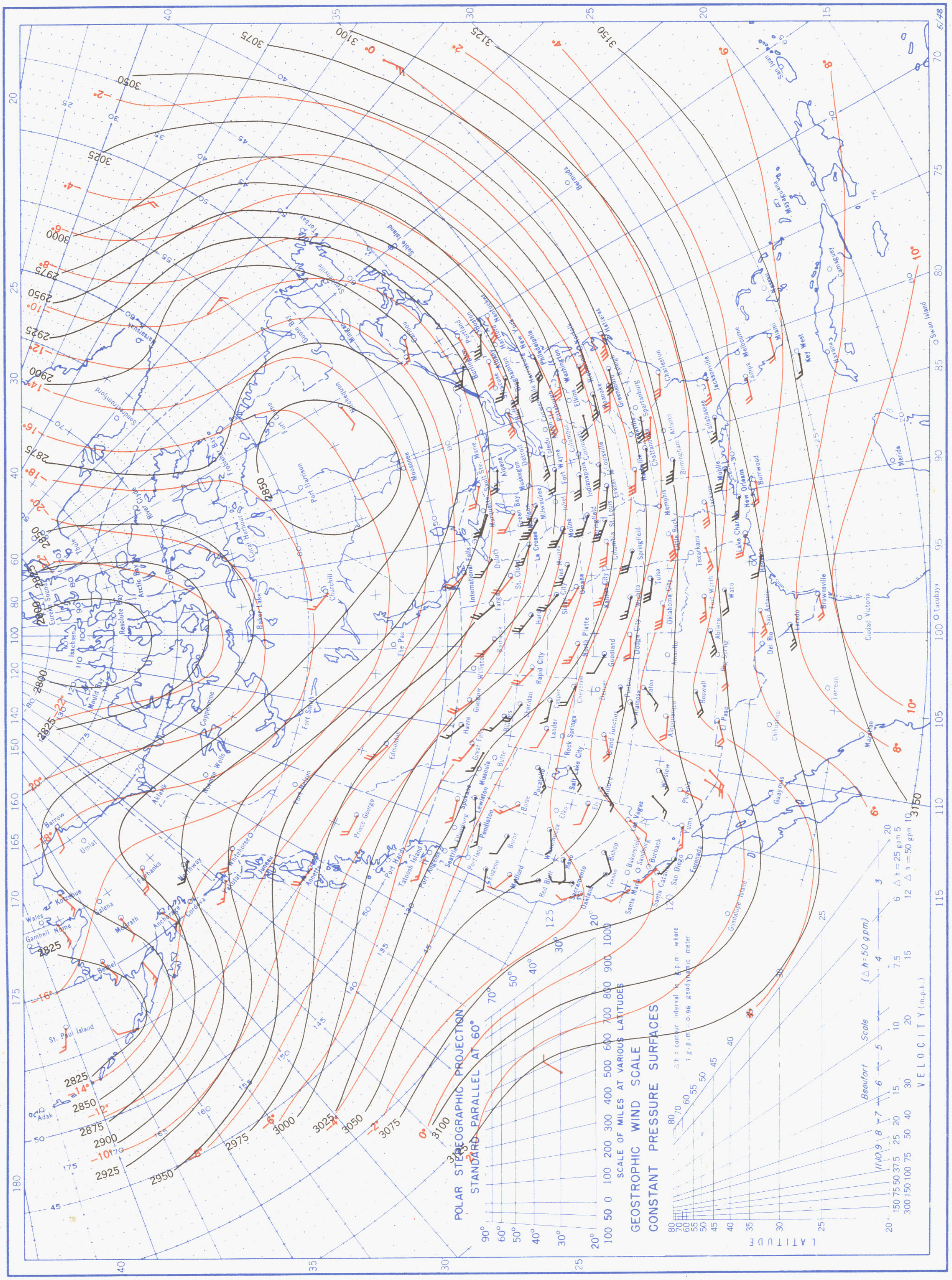
Average sea level pressures are obtained from the averages of the 7:30 a. m. and 7:30 p. m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), April 1956.



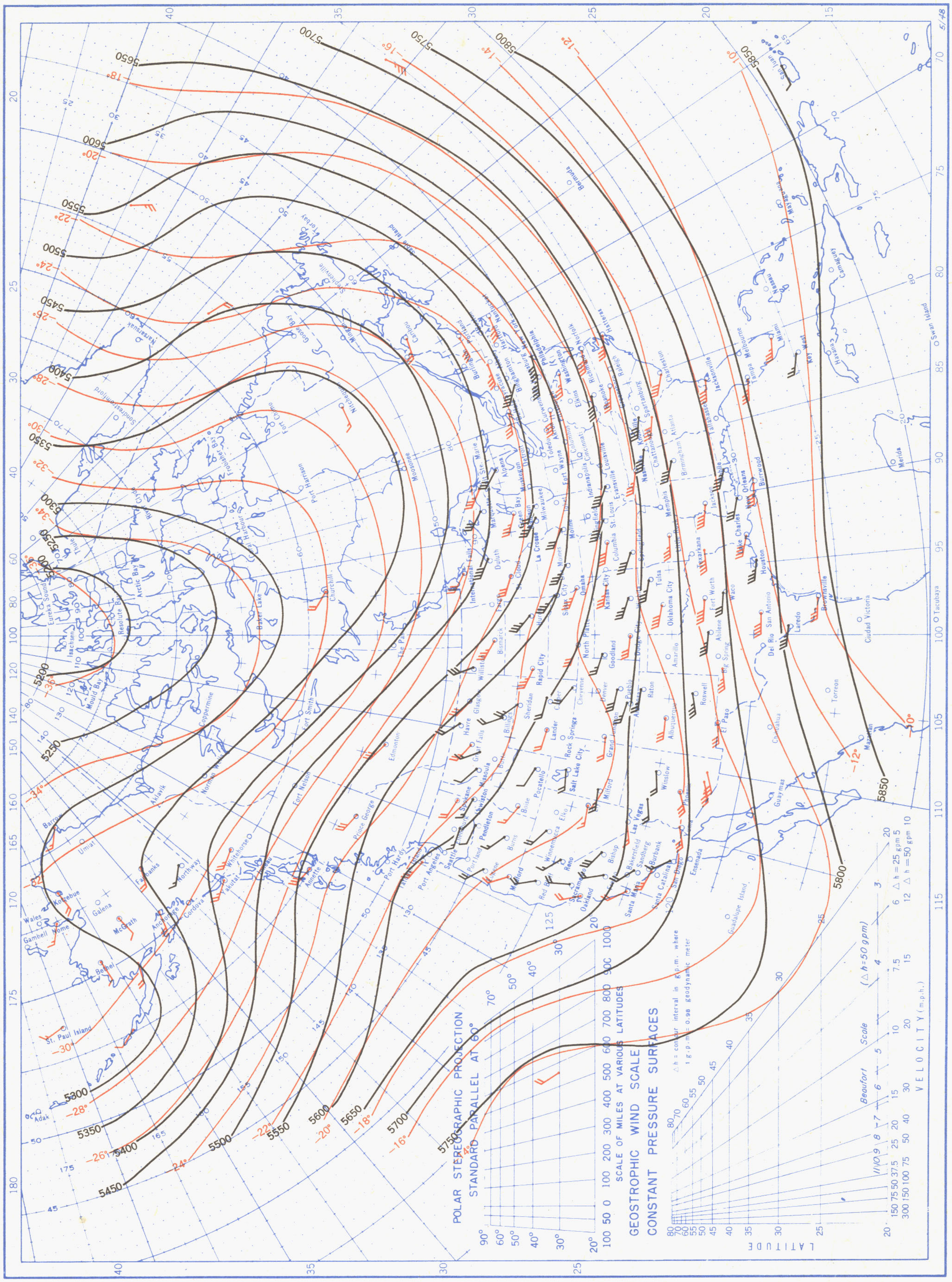
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), April 1956.



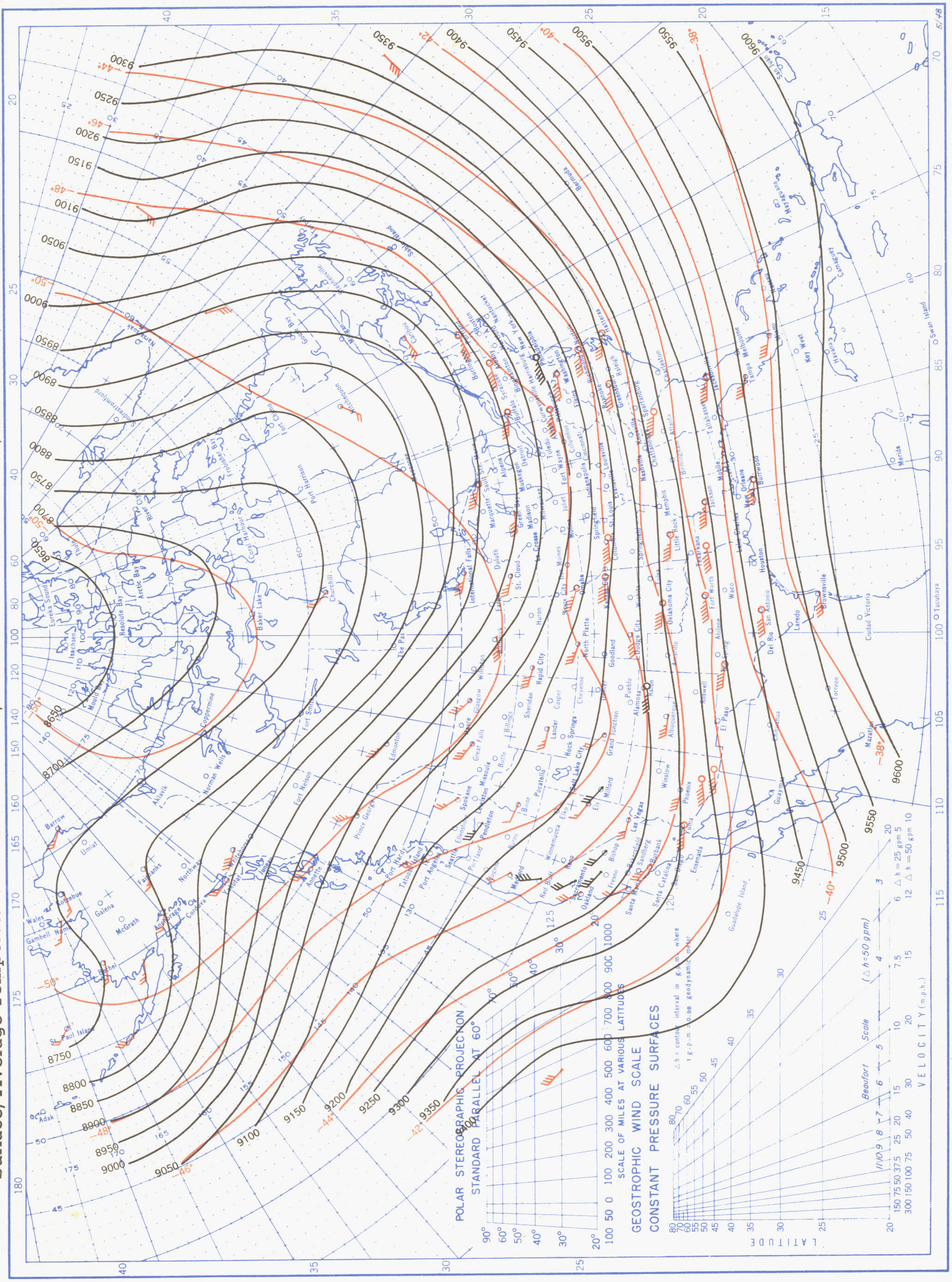
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m.s.l.), April 1956.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), April 1956.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.